RAM GROUP *The Risk Assessment & Management Group of Gannett Fleming, Inc.*

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April 20, 2011

Amber Whisnant
Project Manager
US EPA Region 7
901 North 5th Street
Kansas City, KS 66101

RE: The Boeing Company Tract 1, Hazelwood, Missouri

Dear Amber:

Enclosed for your review is the preliminary draft copy of the Corrective Measures Study (CMS) for the referenced site. Please note this document has been prepared primarily for discussion purposes. Based on your and MDNR's review comments, Boeing will submit a formal CMS report.

Please call me if you have any questions.

Sincerely,

Atul Salhotra

Atul M. Salhotra, Ph.D.
Vice President

cc: Christine Kump-Mitchell, MDNR (w/o enclosure)
Joe Haake, Boeing (w/o enclosure)

RCRA

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Draft for Review

Focused Corrective Measures Study
The Boeing Company Tract 1
Hazelwood, Missouri

Prepared for:

The Boeing Company
Environment, Health and Safety
Integrated Defense Systems
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March 2011

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ABBREVIATIONS

AUL	Activity and Use Limitation
bgs	Below Ground Surface
BNI	Bechtel National, Incorporated
Boeing	The Boeing Company
CMS	Corrective Measures Study
COC	Chemical of Concern
DCE	Dichloroethene
DRO	Diesel Range Organic
DWS	Drinking Water Standard
EPC	Exposure Point Concentration
ft	Feet
FUSRAP	Formerly Utilized Sites Remedial Action Program
gpm	Gallons per Minute
GRO	Gasoline Range Organic
HASP	Health and Safety Plan
HI	Hazard Index
HISS	Hazelwood Interim Storage Site
HQ	Hazard Quotient
HRC	Hydrogen Release Compound
IELCR	Individual Excess Lifetime Cancer Risk
LNAPL	Light Non-Aqueous Phase Liquid
MACTEC	MACTEC Engineering and Consulting, Inc.
MDNR	Missouri Department of Natural Resources
mg/L	Milligrams per Liter
MRBCA	Missouri Risk-Based Corrective Action
ORO	Oil Range Organic
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
PAH	Polycyclic Aromatic Hydrocarbon
PCE	Tetrachloroethylene
PCB	Polychlorinated Biphenyl
PPE	Personal Protective Equipment
QA/QC	Quality Assurance and Quality Control
RAGS	Risk Assessment Guidance for Superfund
RAM	Risk Assessment & Management Group, Inc.
RAM Group	RAM Group of Gannett Fleming, Inc.
RBCA	Risk-Based Corrective Action
RC	Representative Concentration
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
SLAPS	St. Louis Airport Site
SVOC	Semi-Volatile Organic Compound
SWMU	Solid Waste Management Unit

TCE	Trichloroethene
Tetra Tech	Tetra Tech EM, Inc.
TPH	Total Petroleum Hydrocarbon
µg/L	Micrograms per Liter
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VC	Vinyl Chloride
VDEQ	Virginia Department of Environmental Quality
VOC	Volatile Organic Compound
WWTP	Waste Water Treatment Plant

EXECUTIVE SUMMARY

The Boeing Tract 1 Facility (site) is located in Hazelwood, St. Louis County, Missouri and covers a total area of about 228 acres. There have been numerous investigations at the site resulting in an approved Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) Report (1995), RCRA Facility Investigation (RFI) Report (2004), a corrective measures study (CMS) work plan (2010), and risk assessment reports (2004 and 2008). Several interim actions consisting of soil removal, additions of bio-stimulants, and light non-aqueous phase liquid (LNAPL) removal have also been successfully implemented at the site. This focused CMS builds on these previous efforts.

The focused CMS addresses the following four issues at the site:

Issue No. 1: Sub-areas with risk exceedances,

Issue No. 2: LNAPL in certain wells,

Issue No. 3: Exceedance of drinking water standards (DWS) in groundwater, and

Issue No. 4: Confirmation that future risk from complete exposure pathways associated with groundwater will not exceed regulatory acceptable risks; i.e., confirmation that the plume is stable.

The report describes each of these issues and presents Boeing's preferred alternatives to address them.

Issue No. 1: Sub-areas with Risk Exceedances. Risk evaluation indicated the exceedances of risk for the construction worker due to (i) potential dermal contact with groundwater in Sub-areas 2B and 6B, and (ii) outdoor inhalation of vapors from groundwater in Sub-areas 2C, 3H, and 6B. The latter were due to unrealistic assumptions used in the risk calculations. The CMS proposes to manage the potential future risks to construction workers using institutional controls. Specifically, the controls include the development and implementation of health and safety plans (HASPs) prior to any construction that involves subsurface soil excavation to protect the construction worker. The HASP will include, as appropriate, monitoring requirements as well as the use of personal protective equipment. This HASP would be used in conjunction with the Soil Management Plan already agreed to by the primary owners of the site (Airport, Boeing, and GKN).

Issue 2: LNAPL in Certain Wells. Sporadic and trace amounts of LNAPL has been detected in 14 wells and four sub-areas at the site. LNAPL removal activities have previously been completed at the site. Groundwater samples collected from wells with the trace LNAPL indicated absence of typical dissolved phase hydrocarbon constituents of concern, e.g., benzene, toluene, ethylbenzene, xylenes (BTEX), methyl tert-butyl ether (MTBE), etc. Based on this evaluation, the focused CMS recommends no further action related to this issue.

Issue 3: Exceedance of Drinking Water Standards. Evaluation of groundwater data collected

during recent three monitoring events in 2008 and 2010 indicated that 14 chemicals exceeded DWS or equivalent and are potentially site related. Although there is no current or reasonable future probability of groundwater use, the CMS proposes to install activity use limitations (AULs). These AULs are designed (i) to implement restrictions on the installation of any water use wells, and (ii) to prevent the use of the site for residential purposes.

Issue 4: Future Risks and Plume Stability. Except for the potential future risks to the construction worker, all other current and reasonable risks associated with the groundwater pathway were acceptable. To ensure that these risks remain acceptable, it is necessary to confirm that groundwater concentrations remain stable or decrease. An increase in future groundwater concentration could increase the risk. Therefore, the CMS presents a monitoring plan to sample groundwater for the chemicals that contribute most to the risk through this pathway. The CMS recommends that this monitoring be continued until it can be confirmed that the plumes are stable.

Upon approval of the CMS, it is Boeing's intent to implement the preferred recommendations immediately.

SECTION 1.0
OBJECTIVE AND BACKGROUND

1.1 OBJECTIVE OF STUDY

The Boeing Tract 1 Facility (site) is located in Hazelwood, St. Louis County, Missouri and covers a total area of about 228 acres (Figure 1-1). It is bounded by Lindbergh Boulevard to the west, St. Louis Lambert International Airport to the south and southeast, Cold Water Creek to the east, commercially developed properties to the north and is traversed by Banshee Road and McDonnell Boulevard. The site properties are owned by The Boeing Company (Boeing), GKN, and the Airport, as shown in Figure 1-2.

The Missouri Department of Natural Resources (MDNR) and the United States Environmental Protection Agency (USEPA) approved the *Final Corrective Measures Study Work Plan, The Boeing Company Tract 1* (RAM Group, 2010e) in a letter dated July 7, 2010 (MDNR, 2010b). Refer to Appendix A. This document presents the focused Corrective Measures Study (CMS) prepared in accordance with *Section VII, CMS Work Plan of* the *Missouri Hazardous Waste Management Facility Part I Permit* and is consistent with the guidance contained in the USEPA document *RCRA Corrective Action Plan (Final), OSWER Directive 9902.3-2A* (USEPA, 1994).

The objective of this focused CMS is to identify, evaluate, and propose the preferred remedial alternatives to address the specific areas that exceed regulatory risk and to address groundwater impacts. Areas where the approved risk is acceptable and the groundwater impacts are stable or declining will not be evaluated further. Thus, the focused CMS activities are to help determine the applicability of risk management strategies including remedial options for the site, and identify, select, and recommend the "optimal" remedial technology or a combination. Subsequent to the approval of the focused CMS by the regulatory agencies, the recommended remedial alternative will be implemented.

1.2 CHRONOLOGY OF RELEVANT ACTIVITIES

There have been numerous investigations at the facility including a Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) (SAIC, 1995); Underground Storage Tank (UST) removals/investigations; environmental assessments; and interim remedial activities. These previous assessments/investigations culminated in the approval of the RCRA Facility Investigation (RFI), risk assessment, and CMS Work Plan.

1.2.1 Resource Conservation and Recovery Act Facility Investigation Report

The RFI was prepared by MACTEC Engineering and Consulting, Inc. dated December 2004 (MACTEC, 2004b). The objectives of the RFI were to:

- Determine the nature and extent of impact to the study areas,
- Determine the physical properties and characteristics of the affected media, and
- Obtain the necessary data to support the risk assessment and CMS.

The RFI divided the facility into 18 study areas based on the results of the previous assessments, investigations, location of solid waste management units (SWMUs), and interim remedial measures. The geology and hydrogeology are characterized in the RFI. Aquifer testing was performed and soil samples were collected for analysis of geotechnical parameters. Several soil borings were advanced and temporary piezometers, permanent piezometers, and groundwater monitoring wells were installed. Table 3-1 of MACTEC (2004b) presents a list of the monitoring wells. Soil and groundwater samples were collected, field parameters measured, and samples analyzed using approved laboratory methods for the following constituents:

- Volatile organic compounds (VOCs),
- Polycyclic aromatic hydrocarbons (PAHs),
- Polychlorinated biphenyls (PCBs),
- Total and dissolved metals, and
- Total petroleum hydrocarbons (TPHs).

The primary conclusion of the RFI was that the (i) impacts to soil and groundwater have been adequately identified and delineated, and (ii) impacts are confined to the site and do not extend off-site or cross from the North Tract (portion of site north of Banshee Road) to the South Tract (portion of site south of Banshee Road) or vice versa.

The data collected in the RFI were used in the subsequent risk assessments.

On December 22, 2004, MDNR approved the *Resource Conservation and Recovery Act Facility Investigation (RFI) Report* (MACTEC, 2004b).

1.2.2 Risk Assessments

Two risk assessments were performed:

- *Risk-Based Corrective Action Report, Boeing Tract 1, St. Louis, Missouri* (RAM, 2004), including nine addenda (RAM Group, 2009c-i,k,l).

- *Final Risk Assessment, Boeing Tract 1 Facility, St. Louis, Missouri* (Tetra Tech, 2008), prepared for the USEPA.

On March 16, 2009, the MDNR issued a letter of *Comments on Boeing Resource Conservation and Recovery Act Risk-Based Corrective Action (RBCA) Report Dated September 2004, Hazelwood, Missouri* (MDNR, 2009a). In response to General Comments, 13 addenda were prepared and subsequently approved by the agencies. The MDNR and USEPA approved the *Risk-Based Corrective Action Report, Boeing Tract 1* (RAM, 2004) and addenda in a letter dated August 24, 2009 (MDNR, 2009b). Refer to Appendix B.

1.2.2.1 RAM Risk Assessment

The RAM risk assessment divided the facility into 23 Areas and Sub-areas, each characterized by similarities in factors that affect human health under current and reasonable future land use

conditions (Table 1-1 and Figure 1-1). The soil and groundwater data set compiled for use in the risk assessment was from the approved RFI. The receptors, pathways, and complete routes of exposure for current and future land use were identified for each Area/Sub-area.

The large number of constituents analyzed in soil and groundwater were screened to identify the chemicals of concern (COCs) for which quantitative risks were calculated. The cumulative risk for each receptor in each Area/Sub-area was calculated. Further, the risk assessment included an evaluation of the potential impacts to Cold Water Creek and concluded the absence of ecological risks.

Based on comments received from the MDNR (MDNR, 2009a), and with the Agencies' concurrence, RAM Group prepared 13 addenda (RAM Group, 2009c-i,k,l, 2010a,h-j) to address these comments. These addenda, considered a part of the approved risk assessment, dealt with the following issues:

1. Changes in toxicity values and risks,
2. Changes in exposure factors and risks,
3. Laboratory qualifiers,
4. Chemicals with maximum detected concentrations greater than 10 times representative concentrations,
5. Protection of surface water,
6. Uncertainty analysis in the risk assessment,
7. Sensitivity analysis for buildings with and without basements,
8. Errata notice to correct typos and errors in the risk assessment,
9. Effect of changes in toxicity values and exposure factors on risks,
10. Risk evaluation of TPH for indoor inhalation pathway,
11. TPH risk for outdoor inhalation of vapors from groundwater by future construction worker in Sub-area 3C,
12. Risk evaluation for outdoor inhalation of vapors from groundwater by outdoor worker in Sub-areas 2C and 6B, and
13. Risk evaluation for outdoor inhalation of vapors from groundwater by future construction worker in Sub-areas 2C, 3H, and 6B.

The approved risk assessment indicated that the cumulative risks exceeded the regulatory

acceptable risks in Sub-areas 2B and 6B (Figure 1-1). Risk exceedances were identified for the future construction worker due to dermal contact with impacted groundwater in Sub-areas 2B by tetrachloroethene (PCE) and 6B by benzo(a)anthracene.

1.2.2.2 Tetra Tech Risk Assessment

Before accepting the results of the RAM risk assessment that generally followed the Missouri Risk-Based Corrective Action (MRBCA) process, the USEPA asked Tetra Tech to perform a RA of selected areas using the USEPA Risk Assessment Guidance for Superfund (RAGS) protocols. The intent was to compare the results obtained using the two risk assessment approaches. The Tetra Tech risk assessment focused on Sub-areas 2C, 3F, 3H, and 6B.

The results indicated that generally the two approaches to risk assessment resulted in similar risk management decisions. Additionally, risks were exceeded for the future construction worker due to groundwater impacts in Sub-areas 2C (outdoor inhalation), 3H (outdoor inhalation), and 6B (outdoor inhalation and dermal contact). Tetra Tech also indicated that risk due to arsenic was exceeded for the outdoor worker as a non-carcinogenic hazard in Subarea 6B soil; however, their calculations did not indicate an exceedance.

Due to errors in the calculation of risk from TPH that relate to the use of concentrations that exceeded the solubility and saturated vapor concentrations, RAM Group re-evaluated the risk due to TPH for the outdoor inhalation pathways. The revised risks were submitted to the MDNR in November 2010 (RAM Group, 2010i,j). Based on this revision, the only risk exceedances will be for the future construction worker due to dermal contact with impacted groundwater in Sub-area 6B by trichloroethene (TCE) and Aroclor 1254 and outdoor vapor inhalation from groundwater in Sub-area 2C by benzene and TPH-GRO (gasoline range organics) and Sub-area 6B by benzene, total 1,2-dichloroethene (DCE), mercury, TCE, vinyl chloride (VC), TPH-GRO, and TPH-DRO (diesel range organics).

1.2.3 Additional Investigations and Interim Actions

Since the completion of the RFI and risk assessment, additional interim remedial measures and groundwater monitoring have been conducted as discussed below. Interim actions were also completed in 1997 at SWMUs 10, 22, 26, and 28 in Areas/Sub-areas 1, 4, and 3D as discussed in the *Measures Completion Report, McDonnell Douglas Aerospace, U.S EPA No. MOD000818963, Tract I Facility, Hazelwood, Missouri* (Heritage Environmental Services, Inc., 1997) and the RFI. These interim actions are not presented further below.

1.2.3.1 Interim Action Remedial Excavation Completion Report (MACTEC, 2006a)

Impacted soil was excavated from Sub-areas 3A, 3E, 6B, and 8B in 2005 and disposed off-site. The objective was to remove impacted soil that could be a source for groundwater impacts. As a part of developing this focused CMS, RAM Group recalculated the representative soil concentrations and the risks for these Sub-areas (3A, 3E, 6B, and 8B). As expected, the calculated risks are different; however, there is no change in the overall risk management decision (refer to RAM Group, 2010e).

Piezometers were installed in each interim action area and groundwater samples were collected and analyzed once prior to and twice after completing the interim action excavations. These include:

- Sub-area 3A – B42N6, B42N7, and B42N8
- Sub-area 3E – B2E3, B2E4, and B2E5
- Sub-area 6B – RC13, RC14, and RC15
- Sub-area 8B – B220N4, B220N5, and B220N6

COCs that exceeded risk, benzo(a)anthracene in Sub-area 6B and TPH-DRO in Sub-areas 3A, 3E, 6B, and 8B, were not detected in any of the groundwater samples analyzed from the four Sub-areas during the two post-excavation sampling events.

1.2.3.2 Interim Measure Completion Report, Solid Waste Management Unit 17 (MACTEC, 2006b)

Impacted soil was excavated in 2005 from SWMU 17 in Sub-area 2B and disposed off-site. The objective was to remove impacted soil that could be a source for shallow groundwater impacts. Hydrogen Release Compound (HRC) was added to the floor of the excavation. Groundwater samples were collected and analyzed from nearby piezometers and monitoring wells prior to the interim action excavation. Three piezometers and a monitoring well (TP-1, TP-2, B51I1, and MW-7S) were removed during the excavation and were not replaced.

A 4-inch diameter stainless steel well screen was placed in the southeast corner of the excavation to a depth of 10 feet (ft) to act as a backfill observation well (SWMU17-OB-1). No post-excavation groundwater sampling was performed as part of the interim action measure.

RAM Group has recalculated the representative soil concentrations and risks for Sub-area 2B by excluding the soil concentrations for samples that were removed during the excavations. As expected, the representative soil concentrations decreased and some increased. Although, the calculated risks are different, there is no change in the overall risk management decision (refer to RAM Group, 2010e).

RAM Group compared and evaluated the groundwater data collected prior to and after the interim action (Boeing, 2010a). The results of the evaluation indicate that bio-attenuation of solvents is active within the excavated area and downgradient of the excavation. Refer to Section 1.2.4 for additional details and other evidence of active anaerobic biodegradation of chlorinated organics.

1.2.3.3 RAM Group Groundwater Sampling

Groundwater sampling was performed in November 2008, April 2010, and November 2010 per the MDNR approved sampling plan. Figure 1-3 shows the locations of the wells, several of which have been gauged and sampled. The results of these events have been submitted to the MDNR and USEPA (RAM Group, 2009a,b,j, 2010f,k). The results of gauging activities are

briefly discussed below:

November 2008

The November 2008 event found that of the 57 wells gauged (48 shallow, 3 intermediate, 5 deep, and 1 backfill), the approximate average groundwater depths were:

- Shallow zone average groundwater depth = 5.6 ft below ground surface (bgs)
- Intermediate zone average groundwater depth = 7.3 ft bgs
- Deep zone average groundwater depth = 12.9 ft bgs

The average horizontal groundwater flow gradients were to the east at 0.01 ft/ft for the shallow zone and to the south and southeast at 0.009 ft/ft in the deep zone.

April 2010

The April 2010 event found that of the 57 wells gauged, the approximate average groundwater depths for each zone were all shallower compared to the November 2008 event as presented below:

- Shallow zone average groundwater depth = 5.5 ft bgs
- Intermediate zone average groundwater depth = 7.0 ft bgs
- Deep zone average groundwater depth = 9.4 ft bgs

The lateral groundwater flow gradients and directions were consistent with the previous event in the shallow groundwater zone (0.01 ft/ft to the east) and deep groundwater zone (0.009 ft/ft to the southeast).

November 2010

During the November 2010 event, 63 wells were gauged. The event included a missing wells search for 15 wells; of which 11 were found, 3 were identified as questionable, and 1 was no longer present because a building had been constructed over that location. Also, 25 wells were surveyed for locations and/or elevations.

Of the 63 wells gauged (53 shallow, 3 intermediate, 6 deep, and 1 backfill), the approximate average groundwater depths for each zone were deeper in the shallow and intermediate zones, but shallower in the deep zone as compared to the April 2010 event as presented below:

- Shallow zone average groundwater depth = 5.7 ft bgs
- Intermediate zone average groundwater depth = 8.6 ft bgs
- Deep zone average groundwater depth = 8.9 ft bgs

1.2.3.4 Abandonment of Monitoring Wells

Seven wells were abandoned on March 7 – 8, 2011 per MDNR approval (MDNR, 2010c),

because they could not be gauged or sampled due to severely damaged wells or the wells required significant maintenance or repair. The abandoned wells were located in Area 1 (B45CMW-3A, B45CMW-3B, and MW-A15), Sub-area 2A (MW-A16 and MW-A7), Sub-area 6B (MW9D), and Sub-area 6C (B25MW4).

1.2.4 Evidence of Active Anaerobic Biodegradation

Active anaerobic biodegradation of chlorinated organics has been documented in Sub-area 2B in 2001. The evidence is based on analytical results and field measurements of biodegradation parameters in monitoring wells MW-5I and MW-9S) located downgradient of the SWMU 17 source area (Harding ESE, 2002).

Enhanced biodegradation has been documented at Sub-area 2B due to the implementation of interim action excavation supplemented by the placement of HRC at SWMU 17 (MACTEC, 2006b). The results of comparison of groundwater data collected from 1998 – 2005 prior to the 2005 interim action with data collected from 2008 – 2010 after the interim action indicated evidence of reductive dechlorination. In the source area, PCE concentrations decreased at SWMU17-OB-1 after the interim action with a corresponding increase in degradation products (1,2-DCE and VC). Also, in a downgradient well, TP-4, chlorinated organic concentrations reversed an increasing trend prior to the interim action with a decreasing trend after the interim action (Boeing, 2010a).

A pilot test in Sub-area 6B consisted of the injection of HRC in June 2002 in nine borings around MW3 and follow-up monitoring in MW3, MW3A (25 ft upgradient), and MW3B (25 ft downgradient). The monitoring results provided definitive evidence of accelerated reductive dechlorination through the use of HRC. The dechlorination process was observed to go to completion with the reduction of TCE to cis-DCE to VC to ethene to ethane (MACTEC, 2004a).

SECTION 2.0
AREAS AND ISSUES INCLUDED IN FOCUSED CMS

This section presents the specific issues that are addressed in this focused CMS. These issues have been identified based on the various activities conducted at the site (refer to Section 1.0), and consistent with the approved CMS Work Plan. Specifically, these issues include:

Issue No. 1: Sub-areas with risk exceedances,

Issue No. 2: Light non-aqueous phase liquid (LNAPL) in certain wells,

Issue No. 3: Exceedance of drinking water standards in groundwater, and

Issue No. 4: Confirmation that future risk from complete exposure pathways associated with groundwater will not exceed regulatory acceptable risks; i.e., confirmation that the plume is stable.

Details of each of the issues are discussed below.

2.1 ISSUE NO. 1: SUB-AREAS WITH RISK EXCEEDANCES

The risk assessment (RAM, 2004 and Tetra Tech, 2008) did not find risk exceedances related to soil concentrations to any receptor or any pathway. The only risk exceedances were for exposure pathways associated with groundwater.

Consistent with the CMS Work Plan, the risks included in the risk assessment (RAM, 2004) have been re-calculated. These re-calculations are consistent with the methodologies approved for this site. Specifically, the re-calculated risks include the combined effects of (i) changes in toxicity, (ii) changes in exposure factors, (iii) use of TPH solubility concentrations for representative concentrations that exceeded solubility limits, and (iv) change in soil representative concentrations due to the result of 2005 interim actions. The recalculation of risks is presented in Appendix C. To ensure consistency with the approved risk assessment, the representative groundwater concentrations were not revised based on the groundwater data collected during the 2008 and 2010 groundwater sampling events.

The re-calculated cumulative risks for each receptor in each area/sub-area are summarized on Table 2-1. The effect of these calculations on the focused CMS is discussed below.

2.1.1 Areas Requiring Further Evaluation

Table 1-1 presents a description of all the risk assessment exposure areas. Refer to Figure 1-1 for the location of these areas. Figure 2-1 and Table 2-2 presents the four sub-areas with risk exceedances based on the updated results of the RAM and Tetra Tech risk assessments. These risks require risk management. The remaining 19 areas/sub-areas do not have any risk exceedances. Thus, with respect to Issue No. 1, related to risk exceedances, the following four sub-areas and receptors will be considered further in the focused CMS (Section 3.0).

2.1.1.1 Future Construction Worker: Outdoor Inhalation of Vapors from Groundwater

Groundwater concentrations in the following three sub-areas caused risk exceedances to the future construction worker due to outdoor inhalation of vapors:

- Sub-area 2C Benzene and TPH-GRO,
- Sub-area 3H Mercury and TPH-DRO, and
- Sub-area 6B Benzene, mercury, 1,2-DCE (total), TCE, VC, TPH-GRO, and TPH-DRO.

2.1.1.2 Future Construction Worker: Dermal Contact with Groundwater

Concentrations in the following two sub-areas caused risk exceedances to the future construction worker due to dermal contact with groundwater:

- Sub-area 2B PCE, and
- Sub-area 6B Benzo(a)anthracene, TCE, and Aroclor 1254.

2.1.2 Risk to Surface Water

No surface water impacts or potential surface water impacts to Cold Water Creek were identified (RAM Group, 2009h).

2.1.3 Ecological Receptors

There were no unacceptable risks to ecological receptors identified in the risk assessment (RAM, 2004).

2.2 ISSUE NO. 2: PRESENCE OF LNAPL IN CERTAIN WELLS

Sporadic occurrences of LNAPL have been observed in Area 1 and Sub-areas 2A, 2B, 2C, and 3C since 2008 (Figure 2-2). Based on an evaluation of the residual LNAPL at the site discussed in detail in the *Evaluation of Light Non Aqueous Phase Liquid* (Boeing, 2011b), LNAPL is not contributing to the dissolved groundwater impacts in any of the areas; therefore, no further remedial action is necessary to address LNAPL issues at the site. This evaluation was submitted to MDNR in February 2011 (Appendix D) and further discussed in Section 4.0.

2.3 ISSUE NO. 3: EXCEEDANCE OF DRINKING WATER STANDARDS

The November 2008, April 2010, and November 2010 groundwater sample results were compared with screening values for the ingestion and domestic use pathway (RAM, 2010c,f,k). The November 2008 comparison is presented in the memorandum *Chemicals in Groundwater Exceeding Screening Values, Boeing Tract 1, St. Louis Missouri* (RAM Group, 2010c), which is included in Appendix E.

Based on the screening results and data evaluation, 14 chemicals (including TPH-GRO, TPH-

DRO, and TPH-ORO) in 10 areas/sub-areas exceeded the screening values as shown in Table 2-3. This issue is further discussed in Section 5.0.

2.4 ISSUE NO. 4: PLUME STABILITY

To address future risk due to complete routes of exposure associated with groundwater impacts, it is important to demonstrate plume stability; i.e., decreasing or stable concentrations of chemicals in groundwater, to ensure that future representative concentrations will not be higher than current concentrations. This condition will ensure that future risks will be less than current risks, and hence acceptable. Thus, plume stability will ensure:

1. No future risk exceedances, and
2. Impacted groundwater does not migrate off-site.

To assess plume stability, groundwater monitoring will be conducted for a period of time sufficient to show a reliably consistent trend in groundwater concentrations. This issue is discussed in Section 6.0.

2.5 SUMMARY OF AREAS AND ISSUES

Table 2-4 summarizes the specific areas and sub-areas, which have one or more of the four issues discussed in this focused CMS.

SECTION 3.0
ISSUE NO. 1 RISK EXCEEDANCES

This section discusses risk exceedances associated with groundwater presented in Section 2.0. There are four sub-areas with risk exceedances; refer to Figure 2-1. Specifically, these exceedances are for the construction worker due to direct contact with and outdoor inhalation of vapors from groundwater. There are no risk exceedances related to soil concentrations. The remaining 19 areas/sub-areas do not have any risk exceedances and are not discussed further.

This section discusses the preferred alternative to manage these risk exceedances.

3.1 FUTURE CONSTRUCTION WORKER EXPOSURES BY DERMAL CONTACT WITH GROUNDWATER

Groundwater concentrations in two sub-areas caused risk exceedances to the future construction worker by dermal contact with groundwater. These sub-areas and the chemicals that caused the risk exceedance are:

- Sub-area 2B PCE, and
- Sub-area 6B Benzo(a)anthracene, Aroclor 1254, and TCE.

3.1.1 Sub-area 2B/PCE

Carcinogenic Risk

For the construction worker in this sub-area, the cumulative individual excess lifetime cancer risk (IELCR) was 3.4×10^{-4}. The primary contributor to this cumulative IELCR is PCE with an IELCR of 3.3×10^{-4} due to dermal contact with groundwater (refer to Table 3B-12(b) in Appendix C).

Non-carcinogenic Risk

For the construction worker in this sub-area, the cumulative hazard index (HI) was 4.6. The primary contributor to this cumulative HI is PCE with a hazard quotient (HQ) of 4.3 due to dermal contact with groundwater (refer to Table 3B-12(b) in Appendix C).

PCE Target Concentration

The carcinogenic and non-carcinogenic risks were calculated using PCE representative concentration (RC) of 19,115 micrograms per liter (µg/L) based on the concentrations from several monitoring wells in this sub-area prior to 2004. To reduce risk from this pathway below the target cumulative IELCR of 1×10^{-4} and the target cumulative HI of 1.0, the groundwater RC of PCE should be below 4,183 µg/L as per the calculations presented in Appendix F. This concentration is referred to as the calculated target concentration.

3.1.2 Sub-area 6B/Benzo(a)anthracene

For the construction worker in this sub-area, the cumulative IELCR was 5.1×10^{-5}, which is below the target cumulative IELCR of 1×10^{-4}. However, the total IELCR of benzo(a)anthracene was 5.0×10^{-5}, which is above the target total IELCR of 1×10^{-5}. The primary contributor to this total IELCR is due to dermal contact with groundwater (refer to Table 3B-12(b) in Appendix C). This risk was calculated using benzo(a)anthracene RC of 126 µg/L based on the concentrations detected once in one well (RC2) in July 2000 with 10 non-detectable concentrations in six other wells. To reduce risk from this pathway below the target total IELCR of 1×10^{-5}, the groundwater RC of benzo(a)anthracene should be below 26 µg/L, the calculated target concentration (refer to Appendix F).

In recent sampling events in 2008 and 2010, 13 samples from 8 wells in 2008 and 2010 yielded all non-detects (<10.0 to <17.0 µg/L) with detection limits below the target concentration. Therefore, benzo(a)anthracene is not a concern.

3.1.3 Sub-area 6B/Aroclor 1254

For the construction worker in this sub-area, the cumulative IELCR was 6×10^{-4} (Table 7 in Tetra Tech, 2008). The primary contributor to this cumulative IELCR is Aroclor 1254 IELCR of 5.3×10^{-4} due to dermal contact with groundwater. This risk was calculated using exposure point concentration (EPC) of 580 µg/L based on the maximum detected concentrations of two detected concentrations (one each in two wells, RC1 and RC2) in July 2000 with 12 non-detectable concentrations in 11 other wells. To reduce risk from this pathway below the target IELCR of 1×10^{-4}, the groundwater EPC of Aroclor 1254 should be below 64 µg/L, the calculated target concentration (refer to Appendix F).

In recent sampling events in 2008 and 2010, 9 samples from 6 wells in 2008 and 2010 yielded all non-detects (<1.0 to <2.08 µg/L) with detection limits below the target concentration. Therefore, Aroclor 1254 is not a concern.

3.1.4 Sub-area 6B/TCE

For the construction worker in this sub-area, the cumulative HI was 880 (Table 7 in Tetra Tech, 2008). The majority contributor to this cumulative HI was due to outdoor inhalation of vapors from groundwater, which is addressed in Section 3.2.

Of the remaining cumulative HI, TCE HQ of 1.6 was due to dermal contact with groundwater, which was calculated using EPC of 1,400 µg/L based on the concentrations from several monitoring wells in this sub-area prior to 2004. To reduce risk from dermal contact with groundwater below the target HI of 1.0, the groundwater target concentration of TCE was calculated as 13 µg/L (refer to Appendix F).

3.2 FUTURE CONSTRUCTION WORKER EXPOSURES BY OUTDOOR INHALATION OF VAPORS FROM GROUNDWATER

Groundwater concentrations in the following three sub-areas caused risk exceedances to the future construction worker due to outdoor inhalation of vapors:

- Sub-area 2C Benzene and TPH-GRO,
- Sub-area 3H Mercury and TPH-DRO, and
- Sub-area 6B Benzene, mercury, 1,2-DCE (total), TCE, VC, TPH-GRO, and TPH-DRO.

Per Tetra Tech risk assessment, the risks for outdoor inhalation of vapors from groundwater to the construction worker were estimated using a trench model as discussed in the *Voluntary Remediation Program Risk Assessment Guidance* (Virginia Department of Environmental Quality (VDEQ)) with the following assumptions:

- Trench dimension of 8 ft length, 3 ft width, and 8 ft depth;
- Groundwater present in the trench at all times;
- Exposure duration of 1 year and exposure frequency of 125 days/year; and
- Exposure time of 4 hrs/day.

These assumptions are overly conservative and not reasonable for the calculation of risk as discussed below.

The trench dimension assumed is small and it is highly unlikely that a construction worker will work continuously in such a trench for 4 hrs/day for 125 days. If a construction worker is working in a trench with larger dimensions, the volume of air mixed with the vapors emitting from groundwater on the trench floor will increase. This will reduce the air concentration in the trench, and hence the risk to construction worker will decrease. Therefore, the assumptions used to calculate risks overestimate the risks.

The trench model assumes the depth to groundwater is less than 8 ft bgs resulting in standing water in the trench continuously for 125 days. This is unlikely since the trenches would typically be dewatered before and during major construction activities. Often time, the depth to construction will be in the 3 – 5 ft bgs range where the utilities are present; therefore, groundwater will not be present in such a trench.

In addition, trench entry would require compliance with Occupational Safety and Health Administration (OSHA) requirements such as air monitoring prior to a construction worker entering the trench. If air monitoring revealed a potential hazardous situation, a construction worker would not work in the trench or would be required to wear protective gear. Further, construction activities involving subsurface excavation in the sub-areas with risk exceedances to the construction worker will require the use of a health and safety plan (HASP), personal protective equipment (PPE), and monitoring to protect the construction worker.

In summary, based on the very conservative assumptions used to estimate the risks per the trench model, the OSHA requirements, the use of a HASP, PPE, and air monitoring, the future

construction worker would not be exposed to unacceptable risks due to outdoor inhalation of vapors from groundwater.

3.3 CONCLUSIONS

Based on the above evaluation, the only receptor potentially exposed to unacceptable risk is the future construction worker due to dermal contact with groundwater for PCE in Sub-areas 2B and TCE in Sub-area 6B.

The risk will be managed through the use of activity use and limitations (AULs). Specifically, a HASP will be developed for all construction projects that require sub-surface excavation in Sub-areas 2B and 6B if dermal contact with groundwater is likely. The specifics of the HASP will be developed prior to initiating construction in these sub-areas.

Other criteria to be followed during soil excavation activities are described in the *Boeing Permitted Facility Excavated Soil Management Plan* (Boeing, 2011a); a copy is provided in Appendix G.

SECTION 4.0
ISSUE NO. 2 PRESENCE OF LNAPL IN CERTAIN WELLS

Sporadic occurrences of LNAPL have been observed in Area 1 and Sub-areas 2A, 2B, 2C, and 3C since 2008 (Figure 2-2). Based on an evaluation of the residual LNAPL at the site discussed in detail in the *Evaluation of Light Non Aqueous Phase Liquid* (Boeing, 2011b), LNAPL is not contributing to the dissolved groundwater impacts in any of the areas; therefore, no further remedial action is necessary to address LNAPL issues at the site. This evaluation was submitted to MDNR in February 2011 (refer to Appendix D).

This section will be finalized based on our upcoming discussions with MDNR.

SECTION 5.0
ISSUE NO. 3 EXCEEDANCE OF DRINKING WATER STANDARDS

This section addresses Issue No. 3, the exceedance of drinking water standards (DWS). The risk assessment (RAM, 2004 and Tetra Tech, 2008) was prepared under the assumption that groundwater at the site and in the immediate vicinity is not currently being used as a source for domestic use and will not be used for domestic purposes in the future. However, a few wells in 10 areas/sub-areas of the site exceed the DWS or equivalent.

The following text presents (i) the areas of the site where groundwater concentrations since 2008 have exceeded the DWS or equivalent, (ii) an evaluation of groundwater use at the site and the immediate vicinity, and (iii) the management plan for this issue.

5.1 AREAS WITH CHEMICAL CONCENTRATIONS THAT EXCEED GROUNDWATER SCREENING LEVELS

The November 2008 groundwater sample results were compared with the DWS or equivalent values for the domestic use pathway. The results are presented in the RAM Group memorandum *Chemicals in Groundwater Exceeding Screening Values, Boeing Tract 1, St. Louis Missouri* (RAM Group, 2010c); refer to Appendix E. Per this evaluation, 14 chemicals exceed DWS or equivalent and are site related. Subsequent two sampling events in April and November 2010 confirmed this evaluation.

Table 2-3 summarizes the site-related chemicals that exceed the DWS or equivalent based on the groundwater results of the November 2008, April 2010, and November 2010 events.

5.2 ANALYSIS OF CURRENT GROUNDWATER USE

5.2.1 Identification of Existing Water Supply Wells

According to the RFI (MACTEC, 2004b), eight private wells were identified within a 3-mile radius of the Formerly Utilized Sites Remedial Action Program (FUSRAP) North County Site consisting of the St. Louis Airport Site (SLAPS) and the Hazelwood Interim Storage Site (HISS) (USACE, 2003). Well depths range from 35 ft to 400 ft and none are currently used as a drinking water source. Four are irrigation wells and one is an industrial supply well. Three other wells had been used for domestic purposes, but were capped and abandoned in 1962, 1968, and 1979 (BNI, 1992). Most of these wells were installed into fractured bedrock for better yields than can be obtained from the shallow unconsolidated formation (USACE, 2003).

5.2.2 Reasonable Probability of Impact by Site Chemicals of Concern

There is no probability of impact to the off-site wells identified above since (i) the site COCs plume has been defined on-site, and (ii) the groundwater flow direction at the site is to the east and southeast away from the wells.

5.2.3 Current Groundwater Use Pathway

The groundwater use pathway (domestic consumption) is not complete at the site, nor within three miles of the site based on previous investigations (see above).

5.3 ANALYSIS OF FUTURE GROUNDWATER USE

The site and vicinity are highly developed with commercial/industrial facilities primarily associated with the adjacent St. Louis Lambert International Airport. Future development would likely consist of renovations and redevelopment for similar purposes.

The primary source of drinking water in the St. Louis area is surface water from the Mississippi, Missouri, and Meramec Rivers. Aquifers also exist in both the bedrock and unconsolidated deposits along the Mississippi and Missouri Rivers; however, bedrock aquifers are generally not utilized for drinking water purposes in the St. Louis area. At its closest point, the Missouri River is about three miles to the northwest of the site and the groundwater flow at the site is towards the east and southeast away from the river in the site vicinity (MACTEC, 2004b).

5.3.1 Identification of Groundwater Zones

The hydrogeologic units at the site consist of shallow surficial groundwater, deep surficial groundwater, and bedrock (MACTEC, 2004b).

The unconsolidated surficial (non-bedrock) groundwater has been divided into two zones: shallow groundwater and deep groundwater, based upon lithology, occurrence of groundwater, and groundwater geochemistry. These two groundwater zones are separated by a low permeability clay (aquitard). Differences between the shallow and deep geochemical parameters measured at the site and at SLAPS along with a comparison of radioisotope concentrations between the zones conducted at SLAPS suggest no or limited hydraulic communication between the zones (MACTEC, 2004b).

The surficial groundwater is underlain by limestone bedrock. Shale bedrock overlies the limestone in the southwest portion of the site, but is absent to the east and north. The three groundwater intervals can be further described as follows (MACTEC, 2004b):

- Shallow Groundwater – extends from ground surface to the top of the organic silt layer that overlies the dense clay. Groundwater in this zone typically extends from about 4 to 20 feet bgs.

- Deep Groundwater – includes the low permeability clay (aquitard) that separates the deep and shallow groundwater zones and the underlying silty clay and basal sands and gravel above the bedrock. Groundwater in this zone is present from about 20 to 80 feet bgs; however, much of this interval is low permeability clay.

- Limestone Bedrock – includes the Ste. Genevieve and St. Louis limestones that underlie the unconsolidated materials. Groundwater in this zone is typically deeper than 80 feet

bgs. The shale bedrock (Cherokee and Marmaton Groups) that underlies the west part of the site does not produce usable quantities of groundwater due to low permeability.

Refer to the RFI (MACTEC, 2004b) for a more detailed description of the geology and hydrology.

5.3.1.1 Shallow Groundwater

The shallow groundwater zone is unconfined and extends from the land surface to the top of the organic silt. Groundwater is typically encountered at 4 to 14 ft bgs. The lithology consists of fill material, loess, and the uppermost beds of lake deposits. At SLAPS, the shallow groundwater was characterized by highly variable groundwater geochemistry including elevated concentrations of sulfates, calcium, nitrate, sodium, and chloride compared to deep groundwater (USACE, 2003).

5.3.1.2 Deep Groundwater

The deep groundwater zone at the site includes the low permeability clay (aquitard) and the underlying silty clay and basal sands and gravels. The lithology within a few feet of the top of the bedrock is highly variable with most areas having tight clay with gravel within the clay matrix. A few areas had a more permeable sand and gravel zone above bedrock. Given the limited occurrence (two borings) of sand and gravel above bedrock, these permeable zones are not considered interconnected, but instead constitute hydraulically isolated beds.

At SLAPS, the deep groundwater was characterized by "remarkably uniform chemical character" (USACE, 2003), with alkalinity as one of the dominant components. The deep groundwater had lower concentrations of calcium, potassium, sodium, magnesium, and iron. Sulfate and chloride were present at very low concentrations (USACE, 1998). The deep groundwater zone also had significantly lower tritium concentrations indicating groundwater older than 50 years (USACE, 1998).

5.3.1.3 Discussion of Shallow and Deep Groundwater

The shallow and deep groundwater zones are considered hydrologically separate, with low or negligible communication between the zones. This is supported by the following:

- Laboratory and field hydraulic conductivity measurements confirm a low permeability clay separating the two groundwater zones.
- At SLAPS, groundwater geochemistry and tritium concentrations are significantly different for the shallow and deep groundwater zones.
- At the site, groundwater geochemistry had similar differences as observed at SLAPS between the shallow and deep groundwater zones.
- Potentiometric groundwater levels are significantly different between the shallow and

deep groundwater zones.

- The occurrence and distribution of COCs is significantly different between the shallow and deep groundwater zones.

Both the shallow and deep groundwater zones have been impacted by site-related inorganic and organic chemicals. No evidence of off-site impacts has been identified.

The shallow and deep groundwater zones are not currently used as a supply for drinking water. The shallow groundwater zone is not reasonably expected to be used in the future due to:

- Anthropogenic impacts typical of near surface groundwater intervals that are exposed to surface runoff, near surface sources such as sewer pipes, leaks and emissions from automobiles, above ground and underground storage tank system spills and releases, dry cleaners releases, and other activities common in highly developed commercial and industrial settings,

- Availability of adequate municipal water supply systems that are sourced by surface water from the Mississippi, Missouri, and Meramec Rivers, and

- Planned AULs.

The deep groundwater zone is not a probable source of future water supply, based on the availability of adequate municipal water supply systems and planned AULs.

If the shallow or deep groundwater zones were considered for water supply purposes, it is unlikely that either could provide the quantity of water needed to support the commercial/industrial facilities typical of this area. Also, considering the presence of adequate municipal supplies, it is not likely that these groundwater zones would be considered.

5.3.1.4 Bedrock Groundwater

The site is located in an area that is not considered favorable for the development of high-yield wells in bedrock aquifers due to "yields generally less than 50 gallons per minute (gpm) in shallow aquifers containing potable water; deeper aquifers yield saline water" (Miller et al., 1974, Figure 11, p. 20). The site is in an area mapped as having high chloride content (approximately 50 milligrams per liter (mg/L)) in the uppermost (Group 1) limestone bedrock aquifer (Miller et al., 1974, Figure 12, p.28). High sulfate concentrations were also reported for areas underlain by Pennsylvanian age rocks, which would include the site due to the presence of the Cherokee and Marmaton Groups. Therefore, the water quality of the uppermost bedrock aquifer is likely poor and not suitable as potable water (MACTEC, 2004b).

The bedrock of Pennsylvanian age shales, interbedded with thin sandstone, siltstone, coal, and limestone beds, does not produce usable quantities of groundwater due to low permeability. These formations are considered an aquitard or barrier to groundwater flow, and in part, protect the lower limestone (Group 1) aquifers from potential impacts from the surface (MACTEC,

2004b).

Based on the degree and extent and locations of impact identified in the deep groundwater zone (MACTEC, 2004b), it is unlikely that the underlying bedrock groundwater zone has been impacted.

If the bedrock groundwater zone was considered for water supply purposes, it is unlikely that it could provide the quantity of water needed to support the commercial/industrial facilities typical of this area, since it is considered massive with limited development of secondary porosity in the site area (MACTEC, 2004b). Also, considering the presence of adequate municipal supplies and the planned AULs, it is not likely that this groundwater zone would be considered.

5.4 MANAGEMENT PLAN

Management of the impacted groundwater at the site will be controlled by the establishment of AULs to prevent both groundwater use and residential property use. The draft AULs are included in Appendix H.

5.5 CONCLUSIONS

The domestic groundwater use pathway for the three groundwater zones at the site is not complete considering the following:

- The groundwater underlying the site is not currently used as a drinking water supply.
- The groundwater underlying the site is not likely to be used in the future for drinking water purposes given (i) the industrial/urban setting, (ii) the zones could not provide an adequate quantity of water to support the commercial/industrial facilities typical of the airport vicinity, and (iii) the availability of an adequate public water supply system.
- The primary source for drinking water in the City of St. Louis and St. Louis County is surface water obtained from the Missouri River, Mississippi River, and Meramec River.
- Boeing will implement AULs at the site that will prevent on-site use of groundwater for domestic uses and prevent land use for residential purposes.

SECTION 6.0
ISSUE NO. 4 PLUME STABILITY

The site has undergone several activities to reduce the chemical concentrations in the groundwater including removal of sources (SWMUs and USTs), interim actions (soil excavations, LNAPL removal, and addition of biostimulants), and natural attenuation. To address future complete routes of exposure associated with groundwater impacts, plume stability is important to ensure that future representative concentrations will not be higher than current concentrations. This condition will ensure that future risks will be less than current risks and hence acceptable. It is necessary to confirm and document plume stability, i.e., the COC concentrations in groundwater are stable or decreasing with time.

Thus, plume stability will ensure:

1. No future risk exceedances, and
2. Impacted groundwater does not migrate off-site.

To assess plume stability, groundwater monitoring will be conducted for a period of time sufficient to show a reliably consistent stable or decreasing trend in groundwater concentrations.

The selection of wells for groundwater monitoring will be based on the objective of evaluating plume stability. Groundwater impacts at this site are not due to a single source, but are a result of several historic sources. The monitoring plan is based on the recognition that there are several small mostly localized plumes. Each risk area/sub-area has one or more different sources, several of which have undergone interim actions. Thus, each area/sub-area, even those located adjacent, may have potentially different COCs.

6.1 GROUNDWATER MONITORING WORK PLAN

The work plan includes a selection of COCs, areas and sub-areas to be monitored, monitoring wells to be used for monitoring, the groundwater sampling methods, the laboratory analysis parameters, quality assurance and quality control (QA/QC) procedures, data evaluation criteria to demonstrate plume stability, and schedule and reporting.

6.1.1 Selection of Chemicals of Concern for Groundwater Monitoring

The groundwater monitoring for plume stability is focused on the specific chemicals that contributed most to the calculated risk. Conservatively, the plan includes all chemicals for which the individual risk exceeded 10% of the acceptable risk. Therefore, all COCs with risk greater than IELCR of 1×10^{-6} or HQ of 0.1 were included. The factor of 10% was selected because considering that the sources have been removed, it is highly unlikely that concentrations will increase by a factor of 10.

Chemicals that meet the above criteria are listed on Table 6-1 and include nineteen chemicals. Of these, the following six chemicals had very few concentrations above the reporting limits. Therefore, these six COCs will be eliminated from the monitoring plan as explained below:

Sub-area 3H

- Methylene chloride
  - It is known that this is a common laboratory contaminant.
  - Three samples were analyzed. One sample had a detected concentration of 5.3 µg/L (J-value) and two samples had concentrations below reporting limits (<5 µg/L and <20 µg/L).
  - The risk greater than 10% of target risk is due to outdoor inhalation of vapors from groundwater by the construction worker (Tetra Tech, 2008). These calculations are based on unrealistic assumptions.

- Mercury
  - One sample was analyzed and had a concentration of 0.5 µg/L in 2003.
  - Seven samples from two wells were collected in 2008 and 2010. Of these samples, one sample had a concentration of 0.06 µg/L (J-value) and six samples had concentrations below reporting limits (<0.2 µg/L). The latest three samples indicated concentrations below the reporting limits.
  - The risk greater than 10% of target risk is due to outdoor inhalation of vapors from groundwater by the construction worker (Tetra Tech, 2008). These calculations are based on unrealistic assumptions.

Sub-area 6B

- Aroclor 1254
  - Historically, 14 samples were collected. Of these, 12 samples had concentrations below reporting limits (<0.5 to <1.0 µg/L). Only two samples had detected concentrations (11 µg/L at RC1 and 580 µg/L at RC2 in 2000).
  - The risk greater than 10% of target risk is due to dermal contact with groundwater by the construction worker (Tetra Tech, 2008). The EPC used to calculate the risk for this pathway was based on the maximum detected concentration.
  - In 2008 and 2010, nine samples from six wells were collected. All nine samples had concentrations below reporting limits (<1.0 to <2.08 µg/L). Therefore, the risk based on the recent results will be significantly lower than 10% of target risk.

- Benzo(a)anthracene
  - Historically, 11 samples were collected. Of these, one sample had detected concentration of 250 µg/L (at RC2 in 2000) and ten samples had concentrations below reporting limits (<5 µg/L).
  - The risk greater than 10% of target risk is due to dermal contact with groundwater by the construction worker (Appendix C and Tetra Tech, 2008).
  - In 2008 and 2010, 13 samples from eight wells were collected. All 13 samples had

not-detected results (<10.0 to <17.0 µg/L). Based on the recent analytical results, the risk for this pathway will be lower than 10% of target risk.
  - The primary source in Sub-area 6B is chlorinated solvents.

- Chloroform

  - It is known that this is a common laboratory contaminant.
  - Historically, 157 samples were collected. Of these, only six samples had detected concentrations (from 5.4 to 11.0 µg/L) and 151 samples had concentrations below reporting limits (<1.0 to <500 µg/L).
  - The risk greater than 10% of target risk is due to outdoor inhalation of vapors from groundwater by the construction worker (Tetra Tech, 2008). These calculations are based on unrealistic assumptions.
  - In 2008 and 2010, 21 samples from eight wells were collected. All 21 samples had concentrations below reporting limits (<5.0 to <1,000 µg/L).
  - The primary source in Sub-area 6B is chlorinated solvents.

- Dichlorodifluoromethane (Freon-12)

  - It is known that this is a common laboratory contaminant.
  - Historically, 124 samples were collected from 15 wells. Of these, two samples had detected concentrations (2.6 µg/L and 700 µg/L in 2003). The remaining 122 samples had concentrations below reporting limits (<1.0 to <100 µg/L).
  - The risk greater than 10% of target risk is due to indoor inhalation of vapors from groundwater by the indoor worker and outdoor inhalation of vapors from groundwater by the construction worker (Tetra Tech, 2008).
  - In 2008 and 2010, 21 samples from eight wells were collected. Of these, 20 samples had not-detected results (<10.0 to <2,000 µg/L). Only one sample had detected concentration of 2,000 µg/L with "J" laboratory qualifier, which is estimated concentration.
  - The detects (3 of 145 samples from up to 15 wells) are very few and sporadic.
  - The primary source in Sub-area 6B is chlorinated solvents; therefore, this chemical is not believed to be site related.

6.1.2 Areas and Sub-areas

Based on the above considerations, 11 areas/sub-areas, namely 2B, 2C, 3A, 3B, 3F, 3G, 3H, 4, 6B, 6C, and 9, had chemical concentrations that caused risks of 10% the target risk or greater.

Five of these areas/sub-areas (3B, 3F, 3G, 4, and 9) do not have monitoring wells. The COCs in these areas/sub-areas did not cause risk exceedances and consist of mostly TPH-GRO, TPH-DRO, and TPH-ORO with benzene in only one sub-area. These chemicals readily biodegrade with time and the sources have been removed. Therefore, it is very unlikely that chemical concentrations of these chemicals would increase with time. Additionally, risk was calculated using data collected prior to 2004; therefore, the current chemical concentrations should be less and likely no longer contributing to 10% of the target risk. Therefore, it is not necessary to

install monitoring wells in these five areas/sub-areas.

6.1.3 Selection of Monitoring Wells

It is important to select monitoring wells based on the specific groundwater COCs in each area/sub-area. In each area/sub-area, selected wells will be upgradient of the source, within the source area, and just downgradient of the source, if possible. In some areas only source wells may be available. Table 6-2 lists the 22 wells to be monitored, including 1 backfill, 16 shallow, 3 intermediate, and 2 deep zone wells.

6.1.4 Groundwater Sampling Methods

To the extent possible, groundwater sampling will be performed using snap sampling systems with a few wells using low-flow methods. Application of snap samples at this site has been approved by MDNR (MDNR, 2011). Of the 22 wells, about 19 wells will use snap samplers (wells that are 2-inch or greater diameter), and 3 wells will be sampled using low-flow methods (wells less than 2-inch diameter). Table 6-2 indicates the preferred sampling method for each monitoring well. Some wells will be sampled using a peristaltic pump, which will be determined at the time of sampling due to conditions that are not conducive to low-flow sampling, such as, presence of LNAPL, short water columns, well obstructions, or other issues.

6.1.5 Laboratory Analysis Methods

The following are the laboratory analysis methods to be used for the various COCs:

- EPA Method 8260 for VOCs and/or TPH-GRO, and
- EPA Method 8270 for TPH-DRO and/or TPH-oil range organic (ORO).

Note the wells in each area/sub-area will be sampled for the COCs per Table 6-1.

Should there be increasing concentrations in TPH-GRO, TPH-DRO, or TPH-ORO, it may be necessary to select a few samples for fractionation analysis of the aliphatic and aromatic carbon ranges.

6.1.6 Quality Assurance and Quality Control Samples

Field QA/QC samples will include blind duplicates (at rate of 5%), field equipment rinsate blanks (one per day from decontaminated equipment), and trip blanks (one per shipment of VOC samples). The duplicates and field equipment rinsate blanks will be analyzed for the same parameters as the original samples. The trip blanks will be analyzed for VOCs using Method 8260.

6.1.7 Groundwater Gauging

The shallow and intermediate wells in Table 6-2 will continue to be gauged during the groundwater sampling events to estimate groundwater flow gradients and directions and to

monitor the presence and thickness of LNAPL in the few wells with minor residual LNAPL. All seven deep wells will continue to be gauged.

6.2 DATA EVALUATION CRITERIA

The data will be evaluated to demonstrate plume stability. Some or all of the following methods will be used to evaluate the data:

1. Chemical concentration contour maps,
2. Concentration vs. time plots,
3. Concentration vs. distance plots, and
4. Statistical and visual analysis of plots.

6.3 SCHEDULE AND REPORTING

Groundwater monitoring will be performed on a semi-annual basis, data will be evaluated and a brief transmittal letter will be submitted to the agencies with the data. The transmittal letter will summarize the results of the sampling. Comprehensive reports will be submitted annually. Once plume stability can be demonstrated, groundwater monitoring will cease.

6.4 INCREASING CHEMICAL CONCENTRATIONS

Should chemical concentrations show a consistent increase in concentrations, then the circumstances of the increase will be evaluated to determine the cause. Based on the evaluation results and the specific circumstances, it may be necessary to evaluate appropriate remedial options for implementation.

SECTION 7.0
EVALUATION AND SELECTION OF REMEDIAL ALTERNATIVES

The CMS Work Plan (RAM Group, 2010e) determined that some sub-areas with risk exceedances may require additional actions. However, additional work performed as part of the focused CMS and presented in the previous sections has identified the following issues:

1. Risk exceedances to the future construction worker,
2. Presence of LNAPL in certain wells,
3. Exceedance of DWS, and
4. Plume stability.

These issues can be managed using the following:

- Area-specific HASPs, PPE, and monitoring to protect the future construction worker

- AULs to:
  - Prevent on-site groundwater use for potable purposes,
  - Prevent future on-site land use for residential,
  - Restrict intrusive construction, and
  - Perform construction activities under the control of an appropriate HASP.

- Groundwater monitoring to ensure future risks are acceptable

Therefore, it is not necessary to evaluate active remediation alternatives, since the above risk management activities are sufficient and appropriate.

The following remedial options are recommended:

7.1 REMEDIAL OPTIONS

7.1.1 Remedial Options to Address Vapor Inhalation and Dermal Contact Risks

In the CMS Work Plan (RAM Group, 2010e), feasible remedial alternatives were to be identified and evaluated on an area-specific basis to determine the recommended remedial alternative(s). This was based on indoor and outdoor vapor risk exceedances to non-residential workers, outdoor workers, and future construction workers.

However, during the focused CMS, the risks were re-evaluated using methodologies approved for this site (refer to Appendix C), and the only risk exceedances are due to outdoor inhalation of vapors from groundwater and dermal contact with groundwater by the future construction worker. The vapor inhalation risk exceedances are for Sub-areas 2C, 3H, and 6B and the dermal contact risk exceedances are for Sub-areas 2B and 6B.

Since the exposure to future construction workers is very limited, controllable, and can be scheduled, it is not necessary to implement active remedial options. The future construction

worker exposures can be readily mitigated through the use of HASPs specific to each of these sub-areas. The HASP would be modified to address the specific construction project activity and would specify the appropriate PPE, monitoring equipment, and procedures needed to protect the future construction worker.

These HASPs would only be needed for construction projects that require subsurface excavations in Sub-areas 2C, 3H, and 6B due to outdoor inhalation and in Sub-areas 2B and 6B if the construction results in contact with groundwater. The need to continue utilizing the HASP for future construction worker activities will be determined through the use of groundwater monitoring until concentrations of the COCs are below the sub-area specific target concentrations. The requirement for use of HASPs for each of the sub-areas will be controlled through AULs.

7.1.2 Remedial Options to Address LNAPL

In the CMS Work Plan (RAM Group, 2010e), remedial options were to be considered to address the trace presence and sporadic occurrence of LNAPL. However, during the focused CMS, the presence of LNAPL was evaluated (refer to Section 4.0 and Appendix D). Based on this evaluation, LNAPL is not contributing to the groundwater impacts in any of the areas; therefore, no further remedial action is necessary to address LNAPL issues at the site. This applies to Area 1 and Sub-areas 2A, 2B, 2C, and 3C.

7.1.3 Remedial Options to Address Exceedance of Drinking Water Standards

In Section 5.0 the specific areas/sub-areas of the drinking water exceedances have been identified and an evaluation of groundwater use has been performed. Fourteen chemicals have exceeded the DWS or equivalent at least once during the three groundwater sampling events performed since 2008 at various locations on-site. However, as discussed in Section 5.0, the drinking water pathway is not complete at the site. To prevent future use of the site groundwater for drinking water purposes, AULs will be implemented.

7.1.4 Remedial Options to Address Plume Stability

The CMS Work Plan (RAM Group, 2010e) stated that if groundwater concentrations are not stable, then remedial alternatives may need to be considered. Groundwater monitoring will be used to monitor, verify, and document plume stability. A groundwater monitoring plan is presented in Section 6.0. If the plume is stable or decreasing, monitoring will be discontinued. If significant continued increasing trends in chemical concentrations occur, then active measures will be evaluated and applied, if necessary, based on the specific situation.

7.1.5 Activity and Use Limitations

The proposed AUL language is presented in Appendix H. The AULs were developed in accordance with Section 11.0 and Appendix J of the *Departmental MRBCA Guidance Document* (MDNR, April 2006, Updated June 2006 and June 2008) and the *Missouri Environmental Covenants Act* (Missouri General Assembly, 2008). The AULs will be used for the following

purposes:

- To prevent future use of groundwater at the facility for potable purposes.
- To restrict future use of the facility to commercial or industrial purposes only. No residential or other unrestricted use will be permitted.
- To restrict intrusive subsurface construction and maintenance activities in the four sub-areas with risk exceedances to future construction workers, unless performed using specific procedures. The necessary procedures will be based on assessing the subsurface conditions. The construction worker will use appropriate PPE and monitoring equipment under the direction of an area-specific HASP modified to address the specific intrusive activities.

The AULs will be durable, reliable, and enforceable. Boeing and the MDNR will establish appropriate enforcement mechanisms for the AULs.

SECTION 8.0
EVALUATION OF FINAL CORRECTIVE MEASURE ALTERNATIVES

The selected alternatives consist of the following:

- Area-specific HASPs, PPE, and monitoring equipment to protect the future construction worker

- AULs to:
  - Prevent on-site groundwater use for potable purposes,
  - Prevent future on-site land use for residential or other non-restricted purposes, and
  - Restrict intrusive construction or maintenance without assessing subsurface conditions and performing work activities under the control of an appropriate HASP.

- Groundwater monitoring to ensure plume stability

Final corrective measures for the site were evaluated to ensure that they satisfy the following standards specified in the *RCRA Corrective Action Plan* (USEPA, 1994):

- Protect human health and the environment

- Attain media cleanup standards

- Control sources of releases

- Comply with applicable waste management standards

- Other factors
  - Long-term reliability and effectiveness
  - Reduction in toxicity, mobility, or volume of wastes
  - Short-term effectiveness
  - Implementability
  - Cost

The following subsections discuss the above criteria for each alternative.

8.1 PROTECT HUMAN HEALTH AND THE ENVIRONMENT

Corrective measures technologies and the final remedy must be protective of human health and the environment. The risk exceedances, as discussed in Section 3.0, are only for future construction worker exposures to outdoor inhalation and/or dermal contact with groundwater in four sub-areas.

The AULs are designed to be protective of human health and the environment. Groundwater monitoring is performed to ensure plume stability, which will prevent future risk exceedances; thus, also protective of human health and the environment.

The site is owned by Boeing, GKN, and the Airport and access to all areas is strictly controlled by security personnel, fencing, and access badges. These groups also have strict requirements for use of HASPs, PPE, monitoring, OSHA training and medical surveillance for personnel and contractors involved in construction that accesses impacted sub-surface materials as required by the excavated soil management plan (Appendix G). Therefore, these controls will ensure the AULs will be enforced.

8.2 ATTAIN MEDIA CLEANUP STANDARDS

The target concentrations were calculated in Appendix F for chemicals that exceeded the target risk levels due to dermal contact with groundwater by the construction worker. To clean up groundwater to meet these target concentrations are not necessary at the site since the AULs will be in place. If the groundwater concentrations are below the target concentrations, the AULs would not be necessary since the target concentrations are protective of the future construction worker due to dermal contact with groundwater.

Area-specific HASPs, PPE, and monitoring equipment will be utilized to protect the future construction worker. Groundwater monitoring will determine when target concentrations have been attained that are protective of the future construction worker; and thus, the need for area-specific HASPs will no longer be necessary.

8.3 CONTROL SOURCES OF RELEASES

All sources have been removed during interim actions and only residual impacts remain. All except SWMUs #3 and #21 associated with Boeing's active industrial waste water treatment plant (WWTP), have been closed or are no longer in use (refer to Table 8-1). Of the 68 USTs, 10 are still present, of which nine are still active (refer to Table 8-2).

8.4 COMPLY WITH APPLICABLE WASTE MANAGEMENT STANDARDS

Per the activities recommended in this focused CMS, the only wastes generated will include investigation-derived wastes consisting of purged groundwater, decon water, and disposables. Disposables will also be generated by the future construction worker related to PPE and monitoring required under the area-specific HASPs.

All wastes will be handled, stored, transported and disposed following applicable local, state, and federal requirements for Boeing activities.

Construction activities may also generate impacted soil wastes during excavation activities and impacted waste groundwater during dewatering activities. Excavated soil will be managed in accordance with the soil management plan in Appendix G.

8.5 OTHER FACTORS

USEPA's (1994a) *RCRA Corrective Action Plan* cites other general factors for consideration in

selecting a final remedy. These factors represent a combination of technical measures and management controls, including an evaluation of long-term and short-term effectiveness, waste-reduction effectiveness, implementability, and cost. This section addresses the physical and administrative feasibility of implementing remedial systems. Physical feasibility relates to the constraints that could inhibit the installation/construction of remedial systems including buildings and access considerations. Administrative feasibility includes issues such as permitting and regulatory considerations.

8.5.1 Long-term Reliability and Effectiveness

8.5.1.1 Area-specific Health and Safety Plans

HASPs are reliable and effective as long as there is adequate control over the construction activities that will cause potential exposure to the future construction worker to impacted subsurface materials. It is also important that the HASPs are developed for each specific sub-area and addresses the specific chemicals, media, and depths of impact that cause risk exceedances to the workers. The area-specific HASPs must be further modified for each use based on the specific worker activities planned and the current sub-surface conditions. AULs will require the use of HASPs for those specific sub-areas with risk exceedances to the future construction worker.

8.5.1.2 Activity and Use Limitations

AULs that are durable, reliable, and enforceable are reliable and effective for protecting potential receptors from subsurface impacts, thereby eliminating possible human exposure pathways to impacted groundwater and subsurface soil. The AULs will be used to:

- Prevent on-site groundwater use for potable purposes,
- Prevent future on-site land use for residential or other non-restricted purposes, and
- Restrict intrusive construction or maintenance without assessing subsurface conditions and performing work activities under the control of an appropriate HASP.

8.5.1.3 Groundwater Monitoring for Evaluation of Plume Stability

Groundwater monitoring is an effective and reliable method to obtain data for evaluation of plume stability and is the typical industry practice used. The groundwater monitoring plan presents specify the monitoring wells to be sampled, the chemicals and methods for laboratory analysis, and the QA/QC procedures to be used.

8.5.2 Reduction in Toxicity, Mobility, or Volume of Wastes

8.5.2.1 Area-specific Health and Safety Plans

HASPs will not cause a reduction in toxicity, mobility, or volume of wastes; however, HASPs will prevent unacceptable exposures to the affected future construction workers.

8.5.2.2 Activity and Use Limitations

AULs will not cause a reduction in toxicity, mobility, or volume of wastes; however, AULs will prevent unacceptable exposures to human receptors.

8.5.2.3 Groundwater Monitoring for Evaluation of Plume Stability

Groundwater monitoring will not cause a reduction in toxicity, mobility, or volume of wastes; however, it will be used to verify that the plume is stable or decreasing; thus, providing a mechanism for determining if these reductions are occurring.

8.5.3 Short-term Effectiveness

The short-term effectiveness of proposed corrective measures technologies is determined by how quickly the remedy can be implemented and indicates positive results.

8.5.3.1 Area-specific Health and Safety Plans

HASPs can be implemented immediately and will be effective in preventing unacceptable exposures to future construction workers in the four sub-areas with risk exceedances.

8.5.3.2 Activity and Use Limitations

AULs can be implemented immediately and will be effective in preventing future exposure to onsite groundwater for potable purposes, preventing unrestrictive property use for residential purposes, and restricting intrusive construction or maintenance without assessing conditions and performing work activities under the control of an appropriate HASP.

8.5.3.3 Groundwater Monitoring for Evaluation of Plume Stability

Groundwater monitoring can be implemented immediately and will be effective in evaluating plume stability.

8.5.4 Implementability

Implementability describes the relative ease of installation (i.e., constructability). The constructability of a remedial system is related to the conditions of the site, the availability of resources, and what measures can be taken to facilitate construction. External factors include permits or access agreements, equipment availability, and location of appropriate on-site treatment or disposal facilities.

8.5.4.1 Area-specific Health and Safety Plans

HASPs are easy to implement and will be required by AULs for the sub-areas with future construction worker risk exceedances.

8.5.4.2 Activity and Use Limitations

AULs are easy to implement once accepted and approved by the Airport, GKN, and Boeing, as well as, the regulatory agencies.

8.5.4.3 Groundwater Monitoring for Evaluation of Plume Stability

Groundwater monitoring is easy to implement and will be easier since the agencies have approved the use of passive sampling systems (snap samplers) site-wide. Although, a few well will continue to be sampled using low-flow methods, the majority of the wells will utilize snap samplers. This will make sampling more efficient and provide consistent results, since there are very few variables in the snap sampler methodology in comparison to other non-passive methods.

8.5.5 Cost

It is not necessary to develop costs for comparison of alternatives, since the recommended methods have been determined. However, costs are important in identifying the necessary costs for financial assurance. The costs going forward will include the following:

- Development of area-specific HASPs and modifications to address specific future construction worker activity for each occurrence.
- Maintaining and verifying the AULs are in place and up-to-date, durable, reliable, and enforceable on an annual basis and reporting such to the agencies.
- Installation of snap sampler systems in selected wells, as approved by the agencies.
- Semi-annual groundwater monitoring and annual reporting to the agencies.
- Closure of monitoring wells, as approved by the agencies.
- Post-closure activities.

SECTION 9.0
RECOMMENDED FINAL CORRECTIVE MEASURE ALTERNATIVES

The recommended remedial alternatives are presented in the following sections.

9.1 REMEDIAL OPTIONS TO PROTECT CONSTRUCTIN WORKER

The risk exceedances due to outdoor inhalation of vapors by the future construction worker are in Sub-areas 2C, 3H, and 6B. The risk exceedances due to dermal contact with groundwater by the future construction worker are located in Sub-areas 2B and 6B. Therefore, the recommended remedial option is:

- Use of area-specific HASP specific to each of these sub-areas to protect the future construction worker from unacceptable exposures. The HASP should include the appropriate PPE and monitoring based on the following criteria in each sub-area:
  - Specific COCs causing the exceedance,
  - Specific locations within the sub-area with exceedances, and
  - Depth to groundwater.

The need to utilize the area-specific HASP will be determined on a project-by-project basis and if necessary, the HASP should be modified based on the potential exposures related to the specific project requirements, such as:

- Specific location within the sub-area,
- Ground surface covering,
- Depth of excavation and potential contact with groundwater,
- Nature of the construction activities,
- Longevity of exposure, and
- Current sub-surface conditions.

The need to continue utilizing the HASP for future construction worker activities should be based on the results of the groundwater monitoring in those specific sub-areas. When the representative concentrations in groundwater are below the target concentrations for that sub-area, the HASP will no longer be needed.

9.2 REMEDIAL OPTIONS TO ADDRESS EXCEEDANCE OF DRINKING WATER STANDARDS

Since 2008, 14 chemicals have exceeded the DWS or equivalent at least once during groundwater sampling events at various locations. However, it has been determined that the drinking water pathway is not complete at the site. To prevent future use of the site groundwater for drinking water purposes, AULs will be implemented.

9.3 REMEDIAL OPTIONS TO ADDRESS PLUME STABILITY

Groundwater monitoring will be used to monitor, verify, and document plume stability going forward. The data will be evaluated to determine if the plume is stable or decreasing. If the plume is stable or decreasing, the monitoring can be discontinued. If significant continued increasing trends in chemical concentrations occur, then active measures will be evaluated and applied at that time, if necessary, based on the specific situation.

9.4 SUMMARY

Following are the recommended alternatives to manage risk:

1. HASPs for construction worker,
2. AUL to prevent groundwater use,
3. AUL to confirm continued commercial land use, and
4. Monitoring to confirm future risks remain acceptable until plumes are demonstrated to be stable or declining.

SECTION 10.0
RISK MANAGEMENT PLAN

The focused CMS result has identified the sub-areas with risk exceedances, groundwater concentrations that exceed drinking water standards, and plume stability issues. Remedial alternatives to address these specific issues have been recommended.

Once the recommended alternatives have been approved by the agencies, a risk management plan will be prepared to present the steps and schedule needed to implement the corrective actions. The Risk Management Plan will be prepared in accordance with Section 12 of the *Departmental MRBCA Guidance Document* (MDNR, April 2006, Updated June 2006 and June 2008).

SECTION 11.0
PUBLIC INVOLVEMENT PLAN

Agency approved final remedies recommended in this focused CMS will undergo public review and comment before the corrective measures are implemented.

SECTION 12.0
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Table 6-2
Monitoring Wells and Groundwater Analytical Methods
Boeing Tract 1, Hazelwood, Missouri

Area / Sub-area	Monitoring Well	Shallow(S) Intermediate(I) Deep(D) Backfill(B) Wells	Monitor Well Diameter (inch)	Screened Interval (ft btoc)	Sampling Method SS-Snap Sampler or LF-Low Flow	Analytical Methods*			
						VOC	TPH-GRO	TPH-DRO	TPH-ORO
Area 2: Demolished Area (9 wells)									
2B	MW-6S	S	2	5-15	SS	1			
	MW-8I	I	2	32-40	SS	1			
	MW-11S**	S	2	6.5-16.5	SS	1			
	MW-5I	I	2	32-42	SS	1			
	MW-8S	S	2	8-16	SS	1			
	MW-11I**	I	2	32-42	SS	1			
	MW-11D	D	2	64-74	SS	1			
	SWMU17-OB-	B	4	0-11.75	SS	1			
2C	MW-A13	S	2	4.5-14.5	SS	1	1	1	1
Area 3: Retained Area (3 wells)									
3A	B41MW-18	S	2	2-12	SS		1	1	
	B42N6	S	1	5-15	LF		1	1	
3H	B4MW-9**	S	2	10-19.8	SS	1	1	1	1
	B4MW-10	S	2	2-12	Peristaltic*	1	1	1	1
Area 6: GKN Facility (9 wells)									
6B	B28MW3	S	2	2-12	SS	1	1	1	1
	MW7	S	2	7-11.9	SS	1	1	1	1
	B27W3D	S	0.5	21-26	LF	1	1	1	1
	B28MW4	S	2	5.5-20.5	SS	1	1	1	1
	MW3**	S	2	10-19.7	SS	1	1	1	1
	MW9S	S	2	8-18	SS	1	1	1	1
6C	MW5DS	S	2	7-17.08	SS				1
	MW8AS**	S	2	6-16.5	SS				1
	MW8AD	D	2	70-80.5	SS				1
Total Samples						17	11	11	12
QA/QC Samples									
Duplicates (1 per 20 samples)						1	1	1	1
Equipment Blanks (1 per day)						9			
Trip Blanks (1 per shipment of VOC samples)						9			
Totals						**36**	**12**	**12**	**13**

Notes:

** Have Snap Samplers®

VOC / TPH-GRO: Volatile Organic Compounds & TPH-GRO (8260)

TPH-DRO / TPH-ORO: (8270)

Hg: Mercury (7470)

ft btoc: feet below top of casing

Peristaltic*: used peristaltic due to limited water column (2.98ft) on 10/27/10

Table 8-1
Summary of Solid Waste Management Units (SWMUs)
Boeing Tract 1, Hazelwood, Missouri

Area/ Sub-area	Unit	Description	Building	Current Status
1-HH	12	Waste Jet Aircraft and Hydraulic System Spillage, F-18 Silencer	45E	The UST was removed in 1993 and closure certification of the permitted tank was accepted by MDNR in 1993.
	13	Waste Jet Aircraft Fuel and Hydraulic System Spillage Storage Tank, Hush House	45C/45D	The UST was removed in 1989. Ground water monitoring and product recovery was conducted in the area of this UST from 1990 to 2002. MDNR issued a NFA letter in 2002. Closure certification for this permitted tank was not submitted.
	23	Less-Than-90-Day Storage Area	45C/45D	Waste storage was discontinued at this area in 2001.
	26	Former Less-Than-90-Day Storage Area	40	Interim action as required under the corrective action conditions of the hazardous waste facility permit was conducted in 1997. Waste storage at this area had been discontinued prior to the RFA.
1-SOB45	14	Waste Jet Aircraft Fuel Storage Tanks, Fuel Pits #3 and #4	45	The UST was removed in 1992. Ground water monitoring and product recovery was conducted in the area of this UST from 1990 to 1998. MDNR issued a NFA letter in 2002. Closure certification for these permitted tanks was not submitted.
2A	9	Waste Nitric and Hydrofluoric Acid Solution Storage, AST Tanks H1, H2, H3, H4, H5, and H6	52	Closure certification for the permitted ASTs was accepted by MDNR in 1993. The tanks were removed.
	15	Waste Jet Fuel Storage Tank, Ramp Station 1 and 2	45K	The UST was removed in 1993. Ground water monitoring and product recovery was conducted in the area of this UST from 1990 to 1998. MDNR issued a NFA letter in 2002. Closure certification for these permitted tanks was not submitted.
	27	Waste Nitric and Hydrofluoric Acid Scrubber Saddles Drums Storage	52	The drums of non-hazardous waste scrubber saddles were removed for disposal in 1993.
2B	1	Waste Sodium Hydroxide Storage, AST Tanks H19 and H 20	52	Closure certification of the permitted ASTs was accepted by MDNR in 2003. The tanks were removed.
	2	Waste Nitric and Hydrofluoric Acid Solution Storage, AST Tanks H12, H13, and H14	52	Closure certification of the permitted ASTs was accepted by MDNR in 2003. The tanks were removed.
	16	Methyl Ethyl Ketone (MEK)/Methyl Isobutyl Ketone (MIBK) Recovery Unit	48	The recovery unit was removed in 1995.
	17	Perchloroethylene (PCE) Recovery Unit	51	Operation of the unit ceased in 1998 and the equipment was removed. Building 51 was demolished in 2004.
	25	Less-Than-90-Day Storage Area	51	Storage of waste was discontinued in 1998. The prefabricated storage structure was relocated to Tract II.

Table 8-1
Summary of Solid Waste Management Units (SWMUs)
Boeing Tract 1, Hazelwood, Missouri

Area/ Sub-area	Unit	Description	Building	Current Status
3D	22	Paint Booth Satellite Accumulation Drum	2	Interim action as required under the corrective action conditions of the hazardous waste facility permit was conducted in 1997. Boeing operation of this area ceased in 2001.
3E	24	Less-Than-90-Day Storage Area	2	Waste storage was discontinued at this area in 2001.
4	10	Current Waste Oil AST	5	The tank was removed and replaced with a 375-gallon AST located inside of Building 5. Interim measures as required by the corrective action conditions of the hazardous waste facility permit were conducted in 1997. Building 5 was vacated and demolished in 2006.
	11	Former Waste Oil UST	6	The UST was removed in 1988 and closure certification of the permitted tank was accepted by MDNR in 1993.
	28	Leaking Transformer	6	The transformer was decommissioned and removed and Interim action, as required under the corrective action conditions of the hazardous waste facility permit, was conducted in 1997.
5	3*	Wastewater Sludge Collection and Holding Tank	14	Tank is currently in service. The tank was included in the original hazardous waste permit even though it is exempt under the waste water treatment exemption. Sampling was conducted in 1994 and 1995 to remove the tank from permitted status. The closure certification was accepted by MDNR in 2001. The MDNR letter states that "a deed notice and institutional controls are to be put in place as part of the final remedy under site-wide corrective action".
	21*	Industrial Wastewater Treatment Plant Tanks, S-1, S-2, S-3, S-4, E-1, E-2, and E-3	14	The wastewater treatment facility and tanks are still in service. Rinse water from chemical processing is received at the facility from Boeing Tract II and GKN. Tanks S-2 and E-3 were lined in 2008.
6A	29	Waste Ferracoat, Methyl Ethyl Ketone, and Trichloroethylene Drum Storage	29A	Waste storage was discontinued at this area in 2000.

Table 8-1
Summary of Solid Waste Management Units (SWMUs)
Boeing Tract 1, Hazelwood, Missouri

Area/ Sub-area	Unit	Description	Building	Current Status
6B	4	Leaked or Spilled Jet Aircraft Fuel Storage Tank	28	Closure certification of the permitted UST was accepted by MDNR in 1995. The tank was removed in 2000.
	5	Current Reactive Cyanide and Sulfide-Bearing Waste Storage, Area 2	22	The prefabricated storage building was relocated to Tract II in 2000.
	6	Former Reactive Cyanide and Sulfide-Bearing Waste Storage, Area 2	22	All waste was removed and the area decontaminated in 2000. Closure certification of the permitted area was submitted to MDNR in 2000. The storage structure still exists on GKN property.
	8	Scrap Dock Shelter, Area 1	39	All waste was removed and the area decontaminated in 2000. Closure certification of the permitted area was submitted to MDNR in 2000. The storage structure still exists on GKN property.
	31	Maintenance Shop Waste Oil Tank	22	The tank was removed in 1996 and replaced with a 350-gallon AST located inside of a prefabricated metal storage structure equipped with spill containment. Building 22, which was leased by Boeing from GKN, was vacated in March of 2009. The tank and storage structure was relocated to Boeing Tract II.
	32	Polychlorinated Biphenyls (PCB) Storage Area	39	Use of the prefabricated storage building was discontinued in 2000 and the structure was decontaminated in 2001.
6C	18	Methyl Ethyl Ketone/Methyl Isobutyl Ketone Recovery Unit	27	The recovery unit was removed in 1995.
	30	Chemical Etching Spill Containment Area	27	A new tank line and containment system was installed in 2000. GKN continues to operate the chemical process tank line.
9	7	Explosive Waste Storage, Area 3	10	Closure certification of the permitted storage area was accepted by MDNR in 1995. The building still exists on Airport property.
	19	Drum Storage Areas and Related Satellite Accumulation Areas	Numerous	Accumulation and storage of waste was discontinued with the sale of the property to the Airport and GKN in 2000 and 2001.
	20	Paints Solids Satellite Accumulation Areas	Numerous	Accumulation and storage of waste was discontinued with the sale of the property to the Airport and GKN in 2000 and 2001.

Notes:
*: Currently active
AST: Above ground storage tank
UST: Underground storage tank
HH: Hush Houses
SOB45: South of Building 45

Table 8-2
Summary of Underground Storage Tanks (USTs)
Boeing Tract 1, Hazelwood, Missouri

Number	Building	Area/ Sub-area	DNR Tank Registration	Regulated	Volume (gals)	Contents	Construction Materials	Year Installed	Status in 2004	Leak Detection	Remedial Actions
B1	Bldg 41	3A	N/A	Yes	4,000	T-979 Solvent	Single Wall Steel	1947	Removed 1981/not replaced	N/A	Excavated
B2	Bldg 41	3A	N/A	Yes	4,000	Lacquer Thinner	Single Wall Steel	1947	Removed 1981/not replaced	N/A	Excavated
B3	Bldg 41	3A	N/A	Yes	8,000	Aviation Gas	Single Wall Steel	1947	Removed 1981/replaced	N/A	Excavated
B4	Bldg 41	3A	N/A	Yes	8,000	Gasoline	Single Wall Steel	1947	Removed 1981/replaced	N/A	Excavated
B5	Bldg 41	3A	N/A	Yes	4,000	JP-5	Single Wall Steel	1981	Removed 1989/ replaced by F41	N/A	Excavated
B6	Bldg 41	3A	N/A	No	15,000	JP-4	Single Wall Steel	1947	Removed 1957/replaced	N/A	Excavated
B7	Bldg 41	3A	N/A	No	15,000	JP-4	Single Wall Steel	1947	Removed 1957/replaced	N/A	Excavated
B8	Bldg 41	3A	N/A	Yes	15,000	JP-4	Single Wall Steel	1948	Removed 1989/replaced by A41	N/A	Excavated
B9	Bldg 41	3A	N/A	Yes	15,000	JP-4	Single Wall Steel	1948	Removed 1989/replaced by B41	N/A	Excavated
B10	Bldg 41	3A	N/A	Yes	15,000	JP-4	Single Wall Steel	1957	Removed 1989/replaced by C41	N/A	Excavated
B11	Bldg 41	3A	N/A	Yes	15,000	JP-4	Single Wall Steel	1957	Removed 1989/replaced by D41	N/A	Excavated
B12	Bldg 41	3A	N/A	Yes	8,000	Gasoline	Fiberglass Reinforced Plastic	1981	Removed 1989/replaced by E41	N/A	Excavated
B13	Bldg 41	3A	N/A	Yes	8,000	JP-5	Fiberglass Reinforced Plastic	1981	Removed 1989/replaced by F41	Inventory Stick	Excavated
B14	Flight Operations/A-41	3A	8027	No/Exempt	30,000	Jet Fuel	Double Wall Fiberglass	1989	Current	Interstitial Alarm	None
B15	Flight Operations/B-41	3A	8027	No/Exempt	30,000	Jet Fuel	Double Wall Fiberglass	1989	Current	Interstitial Alarm	None
B16	Flight Operations/C-41	3A	8027	No/Exempt	30,000	Jet Fuel	Double Wall Fiberglass	1989	Current	Interstitial Alarm	None

Table 8-2
Summary of Underground Storage Tanks (USTs)
Boeing Tract 1, Hazelwood, Missouri

Number	Building	Area/ Sub-area	DNR Tank Registration	Regulated	Volume (gals)	Contents	Construction Materials	Year Installed	Status in 2004	Leak Detection	Remedial Actions
B17	Flight Operations/D-41	3A	8027	No/Exempt	30,000	Jet Fuel	Double Wall Fiberglass	1989	Current	Interstitial Alarm	None
B18	Company Vehicles/E-41	3A	8027	Yes	8,000	Gasoline	Double Wall Fiberglass	1989	Current	Interstitial Alarm	None
B19	Flight Operations/F-41	3A	8027	No/Exempt	8,000	Water	Double Wall Fiberglass	1989	Current/not in use	Interstitial Alarm	None
B20	Bldg 1	3E	N/A	No	500	Gasoline	Single Wall Steel	1956	Removed 1961/not replaced	N/A	Excavated
B21	Bldg 1	3E	N/A	No	500	Gasoline	Single Wall Steel	1961	Removed 1972/not replaced	N/A	Excavated
B22	Bldg 1	3G	8021	Yes	6,000	Diesel	Single Wall Steel	1972	Removed 1980/not replaced	N/A	Excavated
B23	Bldg 1	3G	8021	Yes	5,000	Gasoline	Single Wall Steel Relined in 1979	1941	Removed 1989/not replaced	Inventory Control	Excavated
B24	Bldg 2	3E	N/A	Yes	1,000	Gasoline/Diesel	Single Wall Coated Tar Epoxy Steel	1942	Removed 1989/not replaced	N/A	Excavated
B25	Bldg 45	2C	N/A	Yes	335	Diesel	Single Wall Steel	1983	Removed 1987/not replaced	N/A	Excavated
B26	Bldg 45C/45D (Site #4)	1	N/A	Yes	3,380	Waste JP-4	Single Wall Steel	1983	Removed 1983/not replaced	N/A	Excavated
B27	Bldg 45C/45D (Site #4)	1	N/A	Yes	3,380	Waste JP-4	Fiberglass Reinforced Plastic	1983	Removed 1989/not replaced	Inventory Stick	Excavated
B28	Bldg 45E	1	N/A	Yes	2,130	Waste JP-4	Fiberglass Reinforced Plastic	1978	Removed 1990/not replaced	Inventory Stick	Excavated
B29		1	N/A	Yes	2,000	Waste JP-4	Single Wall Steel	1977	Removed 1992/Not Replaced	Inventory Stick	Excavated/ Recovery Wells with closure 2002
B30		1	N/A	Yes	2,000	Waste JP-4	Single Wall Steel	1983	Removed 1992/Not Replaced	Inventory Stick	Excavated/ Recovery Wells with closure 2002

Table 8-2
Summary of Underground Storage Tanks (USTs)
Boeing Tract 1, Hazelwood, Missouri

Number	Building	Area/ Sub-area	DNR Tank Registration	Regulated	Volume (gals)	Contents	Construction Materials	Year Installed	Status in 2004	Leak Detection	Remedial Actions
B31	Bldg 45K (Site #1)	2A	N/A	Yes	4,380	Waste JP-4	Fiberglass Reinforced Plastic	1983	Removed 1993/Not Replaced	Inventory Stick	Excavated/Recovery Wells with closure 1999
B32	Bldg 51	2A	N/A	Yes	6,000	Solvents	Single Wall Steel	1977	Removed 1986/not replaced	Inventory Stick	Excavated
B33	Bldg 43 Fuel Farm	3C	UT0005886	Yes	20,000	Jet Fuel	Single Wall Steel	1957	Removed 1991/Not Replaced	Inventory Stick	Excavated total site of 799 cu yds
B34	Bldg 43 Fuel Farm	3C	UT0005886	Yes	20,000	Jet Fuel	Single Wall Steel	1957	Removed 1991/Not Replaced	Inventory Stick	Excavated total site of 799 cu yds
B35	Bldg 43 Fuel Farm	3C	UT0005886	Yes	20,000	Jet Fuel	Single Wall Steel	1957	Removed 1991/Not Replaced	Inventory Stick	Excavated total site of 799 cu yds
B36	Bldg 43 Fuel Farm	3C	UT0005886	Yes	20,000	Jet Fuel	Single Wall Steel	1957	Removed 1991/Not Replaced	Inventory Stick	Excavated total site of 799 cu yds
B37	Bldg 43 Fuel Farm	3C	UT0005886	Yes	20,000	Jet Fuel	Single Wall Steel	1957	Removed 1991/Not Replaced	Inventory Stick	Excavated total site of 799 cu yds
B38	Bldg 6 (Boeing)	4	N/A	No/Exempt	20,000	Fuel Oil	Double Wall Steel/Plastic Coated	1989	Closed in Place	Inventory Control	No action
B39	Bldg 6 (Boeing)	4	N/A	No/Exempt	20,000	Fuel Oil	Double Wall Steel/Plastic Coated	1989	Current	Inventory Control	No action
B40	Bldg 14 (Boeing)	5	N/A	No/Exempt	120,000	Haz Waste Sludge	Concrete with Rubber Liner	1941	Current	Visual Inspection	No action
B41	Bldg 5	3H	N/A	No	15,000	Fuel Oil	Single Wall Steel	1941	Removed 1988	Visual Inspection	Excavated
B42	Bldg 5	3H	N/A	No	15,000	Fuel Oil	Single Wall Steel	1941	Removed 1988	Visual Inspection	Excavated
B43	Bldg 5	3H	N/A	No	6,000	Fuel Oil	Single Wall Steel	1941	Removed 1988	Visual Inspection	Excavated
B44	Bldg 6	4	N/A	Yes	1,000	Waste Oil	Single Wall Steel	1970	Removed 1988	Visual Inspection	Excavated
B45	Bldg 221	8C	N/A	No	5,000	Fuel Oil	Single Wall Steel	1954	Removed 1990/Not Replaced	Visual Inspection	Excavated
B46	Bldg 33	7	N/A	Yes	3,000	Diesel	Single Wall Steel	1960	Removed 1990/Not Replaced	Visual Inspection	Excavated
B47	Bldg 33	7	N/A	No	20,000	Fuel Oil	Single Wall Steel	1960	Removed 1990/Not Replaced	Visual Inspection	Excavated

Table 8-2
Summary of Underground Storage Tanks (USTs)
Boeing Tract 1, Hazelwood, Missouri

Number	Building	Area/ Sub-area	DNR Tank Registration	Regulated	Volume (gals)	Contents	Construction Materials	Year Installed	Status in 2004	Leak Detection	Remedial Actions
B48	Bldg 32	7	N/A	Yes	500	Gasoline	Single Wall Steel	1975	Removed 1990/Not Replaced	Visual Inspection	Excavated
B49	Bldg 33	7	N/A	No	10,000	Fuel Oil	Single Wall Steel	1955	Removed 1990/Not Replaced	Visual Inspection	Excavated
B50	Bldg 34	7	N/A	Yes	850	Diesel	Single Wall Steel	1961	Removed 1990/Not Replaced	Visual Inspection	Excavated
B51	Bldg 34	7	N/A	No	10,000	Fuel Oil	Single Wall Steel	1961	Removed 1990/Not Replaced	Visual Inspection	Excavated
B52	Bldg 22	6B	N/A	Yes	5,000	Leaded Gasoline	Single Wall Steel	1942	Removed 1961 & Replaced	Visual Inspection	Excavated
B53	Bldg 22	6B	N/A	Yes	7,520	Leaded Gasoline	Single Wall Steel	1961	Removed 1989 & Replaced	Inventory Control	Excavated
B54	Bldg 22	6B	UT0008016	Yes	8,000	Unleaded Gasoline	Double Wall Fiberglass	1989	Retrofitted in 1995	Inventory Control	No action
B55	Bldg 22	6B	UT0008016	Yes	10,000	Unleaded Gasoline	Single Wall Fiberglass	1981	Removed in 1995 & Replaced	Inventory Control	Excavated
B56	Bldg 22	6B	UT0008016	Yes	10,000	Unleaded Gasoline	Double Wall Plastic Coated Steel	1995	Current	Interstitial Alarm	No action
B57	Bldg 22	6B	UT0008016	Yes	10,000	Diesel	Single Wall Fiberglass	1981	Removed in 1995 & Replaced	Inventory Control	Excavated
B58	Bldg 22	6B	UT0008016	Yes	10,000	Diesel	Double Wall Plastic Coated Steel	1995	Current	Interstitial Alarm	No action
B59	Bldg 25	6C	UT0005954	Yes	8,000	Methyl Alcohol	Single Wall Steel	1984	Removed in 1995/Not Replaced	Inventory Control	Excavated
B60	Bldg 28	6B	UT0008017	Yes	5,000	Jet Fuel	Single Wall Steel	1955	Removed in 1989 & Replaced	Inventory Control	Excavated
B61	Bldg 28	6B	UT0008017	Yes	5,000	Jet Fuel	Single Wall Steel	1955	Removed in 1989 & Replaced	Inventory Control	Excavated
B62	Bldg 28	6B	UT0008017	Yes	5,000	Waste Jet Fuel	Single Wall Steel	1953	Removed in 1989 & Replaced	Inventory Control	Excavated
B63	Bldg 28	6B	UT0008017	Yes	5,000	Jet Fuel	Double Wall Steel	1989	Removed in 2000/Not Replaced	Inventory Control	Excavated
B64	Bldg 28	6B	UT0008017	Yes	5,000	Jet Fuel	Double Wall Steel	1989	Removed in 2000/Not Replaced	Inventory Control	Excavated

Table 8-2
Summary of Underground Storage Tanks (USTs)
Boeing Tract 1, Hazelwood, Missouri

Number	Building	Area/ Sub-area	DNR Tank Registration	Regulated	Volume (gals)	Contents	Construction Materials	Year Installed	Status in 2004	Leak Detection	Remedial Actions
B65	Bldg 28	6B	UT0008017	Yes	5,000	Waste Jet Fuel	Double Wall Steel	1989	Removed in 2000/Not Replaced	Inventory Control	Excavated/RCRA Corrective Action
B66	Bldg 29	6B	UT0008019	Yes	4,000	Hydraulic Oil	Single Wall Fiberglass	1980	Removed in 1994/Not Replaced	Visual Inspection	Excavated
B67	Bldg 20	6C	N/A	No	250	Fuel Oil	Single Wall Steel	1943	Removed in 1999/Not Replaced	Visual Inspection	Excavated
B68	Bldg 42	3B	N/A	No	Unknown	Aviation Gasoline	Single Wall Fiberglass	Unknown	Removed Date Unknown/Not Replaced	Visual Inspection	Excavated

Notes:
DNR: Department of Natural Resources
Bldg: Building
gals: Gallons
cu yds: Cubic yards
N/A: Not applicable

TABLES

Table 1-1
Exposure Areas Per Approved Risk Assessment
Boeing Tract 1, Hazelwood, Missouri

Area	Sub-area	Description
Area 1		Runway Protection Zone: (includes former Buildings 40, 45L, 45C, 45D, 45E, and parts of former Buildings 45 and 45K).
Area 2		Demolished Area: (includes existing Buildings 45J, 48, and 48A and former Buildings 51, 52, and part of former Building 45K).
	Sub-area 2A	Western portions of existing Building 45J and former Buildings 51 and 52, northwestern corner of former Building 45, northern portion of former Building 45K, and parking lots, entrance road, and open space between these buildings and the west property line.
	Sub-area 2B	Eastern portion of existing Building 45J and former Buildings 51 and 52, northwestern portion of former Building 45, western portions of existing Buildings 48 and 48A, smaller associated former and existing buildings, and associated parking lots and access areas.
	Sub-area 2C	Eastern portions of existing Buildings 48 and 48A, northeastern portion of former Building 45, smaller associated former and existing buildings, and associated parking lots and access areas.
Area 3		Retained Area: (includes existing Buildings 42, 43, 41, 44, 44A, 46, 49, 1, 2, 3, and 4, and former Building 45H).
	Sub-area 3A	Existing Buildings/structures 44, 44A, 46, and 49, western portion of existing Building 41, northern edge of existing Building 42, and associated parking lots and access areas primarily to the west and south of these buildings.
	Sub-area 3B	Open area between existing Buildings 2 and 42 including the parking access area on the western side of existing Building 2.
	Sub-area 3C	All but the northern edge of existing Building 42, existing Building 43, several former buildings/structures to the south of existing Building 42, and associated paved parking and access areas primarily to the east and south of these buildings to the runway on the south.
	Sub-area 3D	Eastern portion of existing Buildings 41, northern half of existing Building 2, and the associated open and parking areas on the west side of existing Building 2.
	Sub-area 3E	Small open area between existing Buildings 2 and 4 including parking and access areas.
	Sub-area 3F	Small rectangular area at the southwestern corner of existing Building 1, including parking and access areas and the southwest corner of existing Building 1.
	Sub-area 3G	Small rectangular area between existing Buildings 1, 2, and 3, including parking and access areas and the northeastern portion of existing Building 1 and the northwestern portion of existing Building 3.
	Sub-area 3H	Existing Building 4 and the open access areas to the north, east, and south sides of the building.
Area 4		Power Plant: (includes former Building 5 and existing Building 6).
Area 5		Industrial Water Treatment Plant: (includes existing Building 14).
Area 6		GKN Facility: (includes existing Buildings 21, 22, 27, 28, 29, 29A, and 39, and former Building 25).
	Sub-area 6A	Existing Buildings 21, 29, and 29A, and all parking lots and open space to the south and west of these buildings.
	Sub-area 6B	The area between existing Buildings 29 and 27, containing existing Buildings 22, 28, 39.
	Sub-area 6C	Former Building 25 and existing Building 27 and parking lots and open space to the south of these buildings and within about 450 feet to the east.
	Sub-area 6D	Parking lots and open areas beginning about 450 feet east of former Building 25 and existing Building 27 and extending to the north, south, and east property lines.
Area 7		Engineering Campus: (includes Buildings 27A, 32, 33, and 34).
Area 8		Office Complex North: (includes existing Buildings 220 and 221).
	Sub-area 8A	Southern portion of existing Building 220, associated parking areas to the south and access areas to the east.
	Sub-area 8B	Northern portion of existing Building 220 and the open area to the northwest of the building to the property boundary including smaller associated existing buildings, parking areas, and unpaved areas along the property boundary.
	Sub-area 8C	Existing Building 221 and the associated parking and access areas to the north, east, and west of the building.
Area 9		Gun Range: (includes existing Buildings 10, 11, 11A, 12, and 13).

Table 2-1
Summary of Cumulative Risks*
Boeing Tract 1, Hazelwood, Missouri

Area	Non-residential Worker		Construction Worker	
	IELCR	HI	IELCR	HI
Area 1	N/A	N/A	3.76E-07	0.16
Sub-area 2A	3.63E-08	0.052	5.57E-07	0.19
Sub-area 2B	7.35E-06	0.72	**3.35E-04**	**4.6**
Sub-area 2C	1.21E-08	0.95	6.05E-08	0.15
Sub-area 3A	1.44E-08	0.017	6.05E-08	0.35
Sub-area 3B	2.01E-09	0.31	1.76E-09	0.039
Sub-area 3C	1.20E-08	0.033	5.88E-08	0.047
Sub-area 3D	1.25E-08	0.075	2.71E-07	0.066
Sub-area 3E	7.48E-09	0.048	8.67E-10	0.72
Sub-area 3F	NA	0.86	NA	0.059
Sub-area 3G	3.61E-08	0.011	2.37E-07	0.33
Sub-area 3H	NA	0.70	2.69E-12	0.040
Area 4	1.10E-10	0.47	5.40E-06	0.042
Area 5	NA	0.00053	8.17E-08	0.022
Sub-area 6A	6.73E-11	0.054	6.85E-08	0.014
Sub-area 6B	1.95E-07	0.0063	5.07E-05	0.90
Sub-area 6C	2.33E-08	0.0038	1.18E-07	0.21
Sub-area 6D	3.08E-09	0.00014	2.95E-07	0.018
Area 7	N/A	N/A	N/A	N/A
Sub-area 8A	9.39E-09	0.00004	1.35E-07	0.020
Sub-area 8B	NA	0.0029	5.59E-10	0.00023
Sub-area 8C	NA	0.064	2.65E-11	0.017
Area 9	1.79E-11	0.19	9.03E-11	0.031

Notes:
Risk in bold exceeds the cumulative acceptable target risk levels.
IELCR: Individual excess lifetime cancer risk
HI: Hazard index
NA: Not available
N/A: Not applicable
Area 7 - No risk calculation was performed since there is no industrial activities.
* Risks re-calculated, refer Appendix C

Table 2-2
Primary Chemicals and Routes of Exposure that Cause Risk and Hazard Exceedances
Combined RAM Group and Tetra Tech Risk Assessments
Boeing Tract 1, Hazelwood, Missouri

Area	COC	Media	Exceedance Due to	Risk Assessment
Sub-area 2B	Tetrachloroethene (PCE)	GW	Dermal contact with groundwater by future construction worker	RAM Group
Sub-area 2C	Benzene	GW	Outdoor inhalation of vapors from groundwater by future construction worker	Tetra Tech
	TPH-GRO Aliphatics >nC5 to nC8	GW	Outdoor inhalation of vapors from groundwater by future construction worker	
	TPH-GRO Aromatics >nC9 to nC18	GW	Outdoor inhalation of vapors from groundwater by future construction worker	
Sub-area 3H	Mercury	GW	Outdoor inhalation of vapors from groundwater by future construction worker	Tetra Tech
	TPH-DRO Aromatics >nC9 to nC18	GW	Outdoor inhalation of vapors from groundwater by future construction worker	
Sub-area 6B	Benzo(a)anthracene	GW	Dermal contact with groundwater by future construction worker	RAM Group
	1,2-dichloroethene (total)	GW	Outdoor inhalation of vapors from groundwater by future construction worker	Tetra Tech
	Benzene	GW	Outdoor inhalation of vapors from groundwater by future construction worker	
	Trichloroethene (TCE)	GW	Outdoor inhalation of vapors from groundwater and dermal contact with groundwater by future construction worker	
	Vinyl chloride	GW	Outdoor inhalation of vapors from groundwater by future construction worker	
	Mercury	GW	Outdoor inhalation of vapors from groundwater by future construction worker	
	Aroclor 1254	GW	Dermal contact with groundwater by future construction worker	
	TPH-GRO Aliphatics >nC5 to nC8	GW	Outdoor inhalation of vapors from groundwater by future construction worker	
	TPH-GRO Aromatics >nC9 to nC18	GW	Outdoor inhalation of vapors from groundwater by future construction worker	
	TPH-DRO Aromatics >nC9 to nC18	GW	Outdoor inhalation of vapors from groundwater by future construction worker	

Notes:
TPH: Total petroleum hydrocarbons
GRO: Gasoline range organics
DRO: Diesel range organics
C: Carbon range
GW: Groundwater

Table 2-3
Site-related Chemicals that Exceed Drinking Water Standards or Equivalent
November 2008, April 2010, and November 2010
Boeing Tract 1, St. Louis, Missouri

COCs	Area 1	Sub-area 2A	Sub-area 2B	Sub-area 2C	Sub-area 3A	Sub-area 3B	Sub-area 3C	Sub-area 3D	Sub-area 3E	Sub-area 3F	Sub-area 3G	Sub-area 3H	Area 4	Area 5	Sub-area 6A	Sub-area 6B	Sub-area 6C	Sub-area 6D	Area 7	Sub-area 8A	Sub-area 8B	Sub-area 8C	Area 9
1,1-Dichloroethane								X								X				X			
1,1-Dichloroethene																X							
1,1,2-Trichloroethane			X																				
Benzene																X							
cis-1,2-Dichloroethene			X													X							
Tetrachloroethene (PCE)			X													X		X					
trans-1,2-Dichloroethene																X							
Trichloroethene (TCE)			X	X											X	X				X			
Vinyl chloride			X		X											X							
Total Organics	**0**	**0**	**5**	**1**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**8**	**0**	**1**	**0**	**2**	**0**	**0**	**0**
TPH-GRO			X																				
TPH-DRO			X																				
TPH-ORO			X																				
Total TPH	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Chromium, hexavalent																	X						
Manganese								X				X				X	X			X			
Total Metals	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**2**	**0**	**0**	**1**	**0**	**0**	**0**
TOTAL COCs	**0**	**0**	**8**	**1**	**1**	**0**	**0**	**2**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**9**	**2**	**1**	**0**	**3**	**0**	**0**	**0**

Table 2-4
Summary of Areas and Issues
Boeing Tract 1, Hazelwood, Missouri

Area	Risk[1]	LNAPL[2]	Drinking Water Standards[3]	Plume Stability[4]
Area 1		X	X	
Sub-area 2A		X	X	
Sub-area 2B	X	X	X	X
Sub-area 2C	X	X	X	X
Sub-area 3A			X	X
Sub-area 3B				X
Sub-area 3C		X		
Sub-area 3D			X	
Sub-area 3E				
Sub-area 3F				X
Sub-area 3G				X
Sub-area 3H	X		X	X
Area 4				X
Area 5				
Sub-area 6A			X	
Sub-area 6B	X		X	X
Sub-area 6C			X	X
Sub-area 6D			X	
Area 7				
Sub-area 8A			X	
Sub-area 8B			X	
Sub-area 8C				
Area 9				X

Notes:
1: For further discussion, refer to Section 3.0
2: For further discussion, refer to Section 4.0
3: For further discussion, refer to Section 5.0
4: For further discussion, refer to Section 6.0

Table 6-1
Chemicals with Risk Greater than Ten Percent of Target Risk
Boeing Tract 1, Hazelwood, Missouri

COCs	Area 1	Sub-area 2A	Sub-area 2B	Sub-area 2C	Sub-area 3A	Sub-area 3B	Sub-area 3C	Sub-area 3D	Sub-area 3E	Sub-area 3F	Sub-area 3G	Sub-area 3H	Area 4	Area 5	Sub-area 6A	Sub-area 6B	Sub-area 6C	Sub-area 6D	Area 7	Sub-area 8A	Sub-area 8B	Sub-area 8C	Area 9
Organics																							
1,1-Dichloroethane																nw, cw							
1,1-Dichloroethene																nw							
1,2,3-Trimethylbenzene																cw							
1,2,4-Trimethylbenzene																cw							
1,4-Dichlorobenzene																cw							
Benzene				cw							CW					cw							
Benzo(a)anthracene																CW, cw							
Chloroform																cw							
Dichlorodifluoromethane																nw, cw							
Methylene chloride												cw											
Tetrachloroethene (PCE)			NW, CW																				
trans-1,2-Dichloroethene																cw							
Trichloroethene (TCE)																nw, cw							
Vinyl chloride			NW, CW													nw, cw							
Aroclor 1254																cw							
Metals																							
Mercury												cw											
Total Petroleum Hydrocarbons																							
TPH-GRO				NW	CW																		
TPH-DRO				NW	CW							NW	NW										
TPH-ORO				NW						NW		NW	NW										NW
TPH-GRO Aliphatics >nC5 to nC8				nw, cw												cw							
TPH-GRO Aliphatics >nC9 to nC18				nw, cw								cw				cw							
TPH-GRO Aromatics >nC9 to nC18				cw								cw				cw							
TPH-DRO Aliphatics >nC9 to nC18				cw						cw						nw, cw							
TPH-DRO Aromatics >nC9 to nC18				cw						cw						cw							
TPH-DRO Aliphatics > nC16 to nC21						NW										CW	CW						
TPH-ORO Aliphatics > nC21 to nC35						NW					CW												

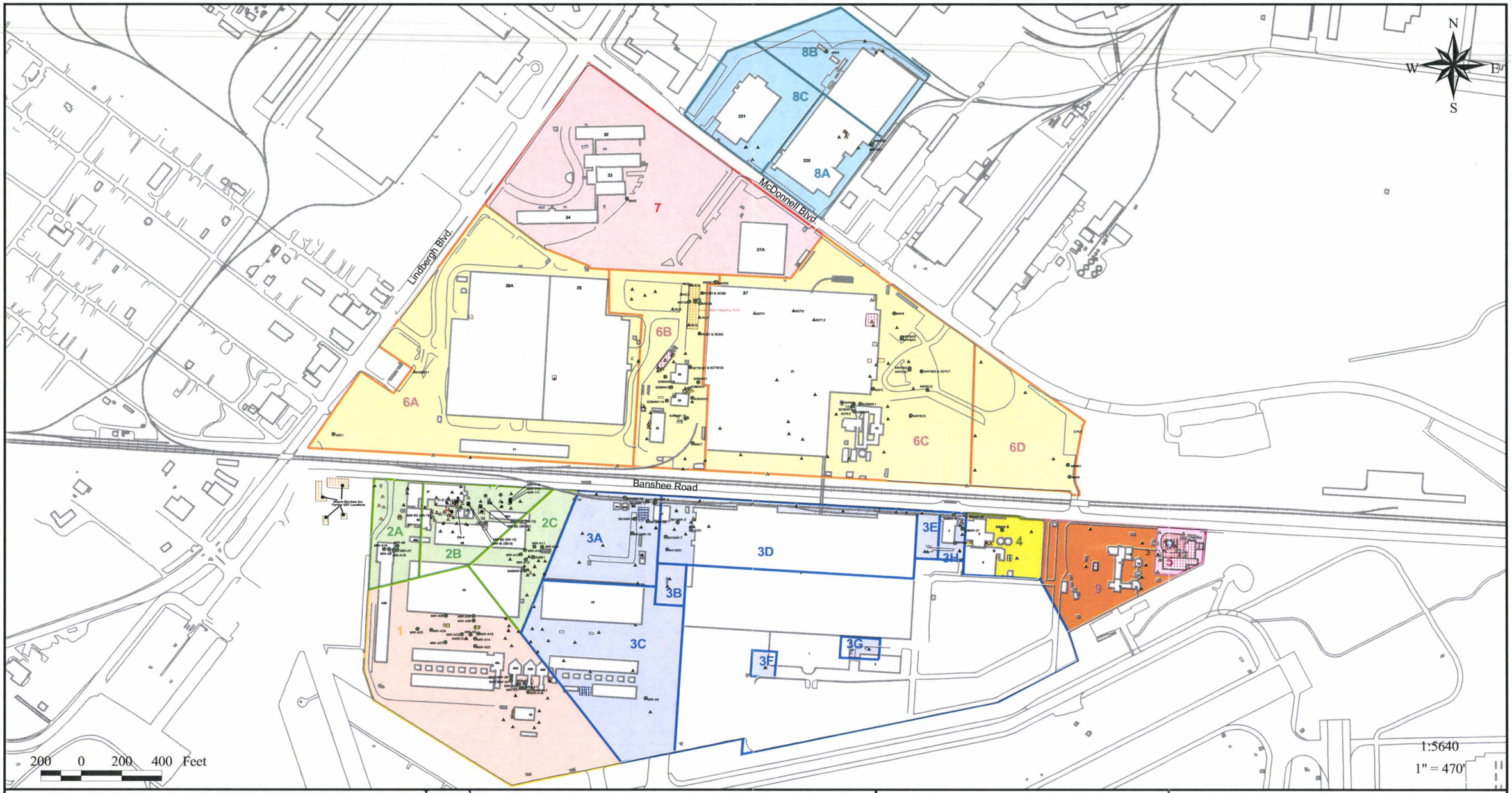
Notes:

NW: Non-residential worker's risk greater than 10% of total target risk (1×10^{-6} for carcinogenic and 0.1 for non-carcinogenic) per RAM Group's Updated Risks

CW: Construction worker's risk greater than 10% of total target risk (1×10^{-6} for carcinogenic and 0.1 for non-carcinogenic) per RAM Group's Updated Risks

nw: Non-residential worker's risk greater than 10% of total target risk (1×10^{-6} for carcinogenic and 0.1 for non-carcinogenic) per Tetra Tech's RA

cw: Construction worker's risk greater than 10% of total target risk (1×10^{-6} for carcinogenic and 0.1 for non-carcinogenic) per Tetra Tech's RA



Legend

Abandoned Shallow Piezometer	RCRA Closure Shallow Boring	Other Area
Abandoned Shallow Well	RFI Deep Boring/Temp. Piezometer	UST
Deep Piezometer	RFI Shallow Boring	SWMU
Deep Well	RFI Shallow Boring/Temp. Piezometer	
Intermediate Well	Shallow Piezometer	
Other Shallow Boring	Shallow Well	
RFA Boring	UST Closure Sample	

Drawn by: BSM Approved by:

Checked by: Date: September 10, 2004

Risk Assessment & Management Group, Inc.

Figure 1-1
Risk Assessment Exposure Area Map, Boeing Tract 1 (North and South)

P:\1_Gis\3250035046\apr\risk\risk_fig1-1_040910.apr

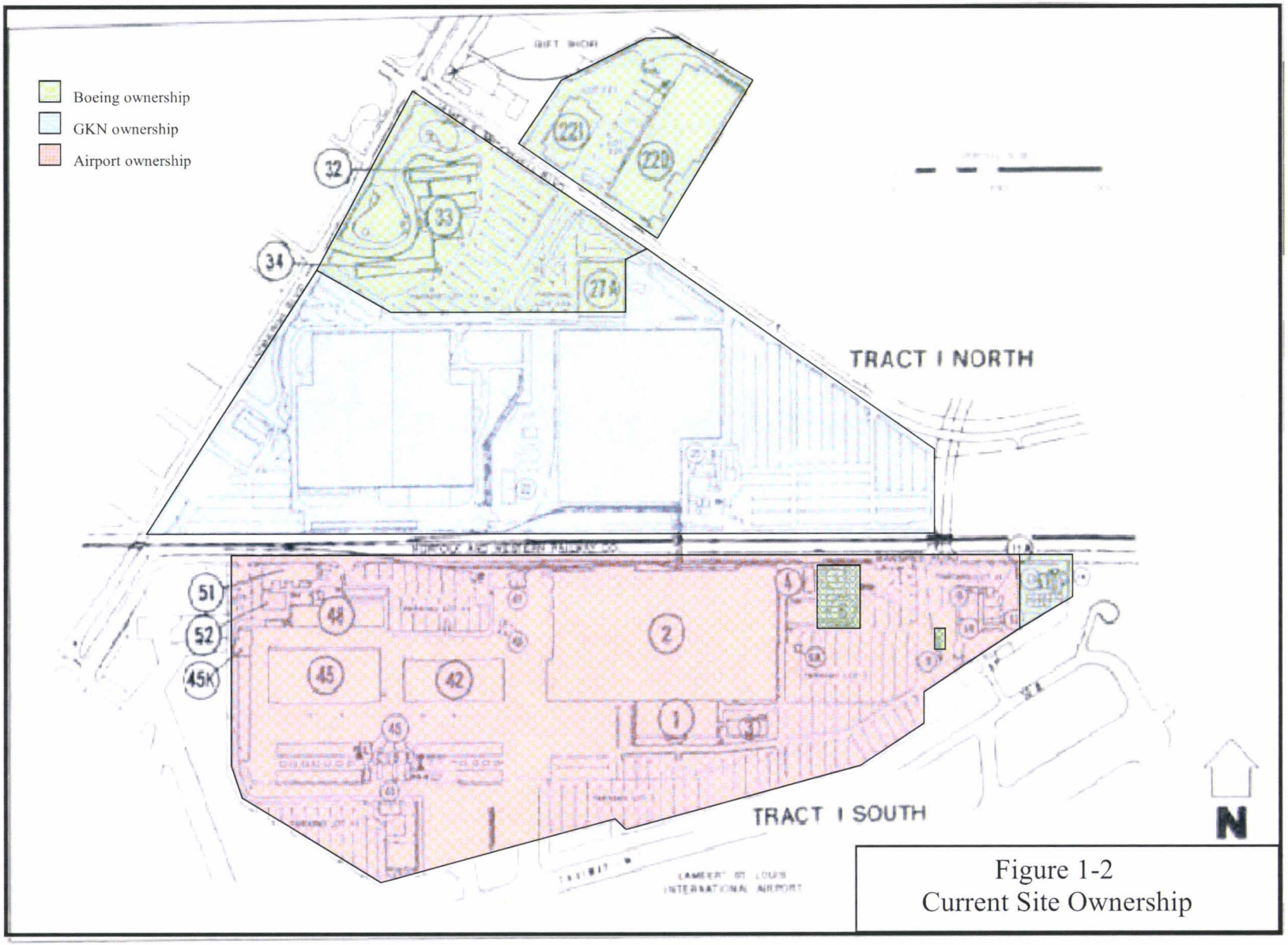
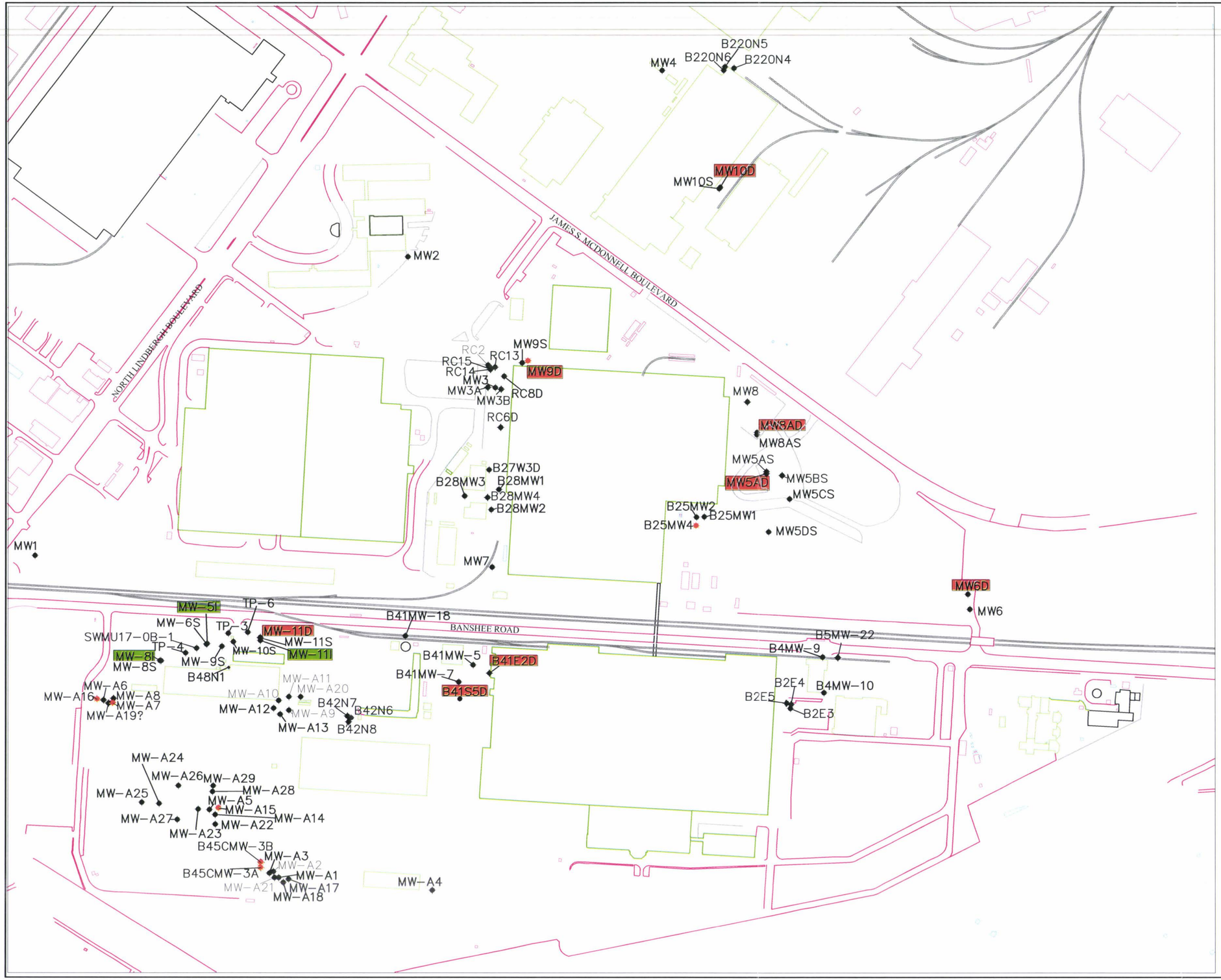


Figure 1-2
Current Site Ownership



N

LEGEND

- Groundwater Monitoring Well
- Railroad
- Roadway
- Current Building Outline
- Deep Well
- Intermediate Well

Wells not highlighted are shallow wells

- Plugged Monitoring Well

MW-A15, B45CMW-3A, B45CMW-3B, MW-A16, MW-A7, MW-9D, and B25MW4

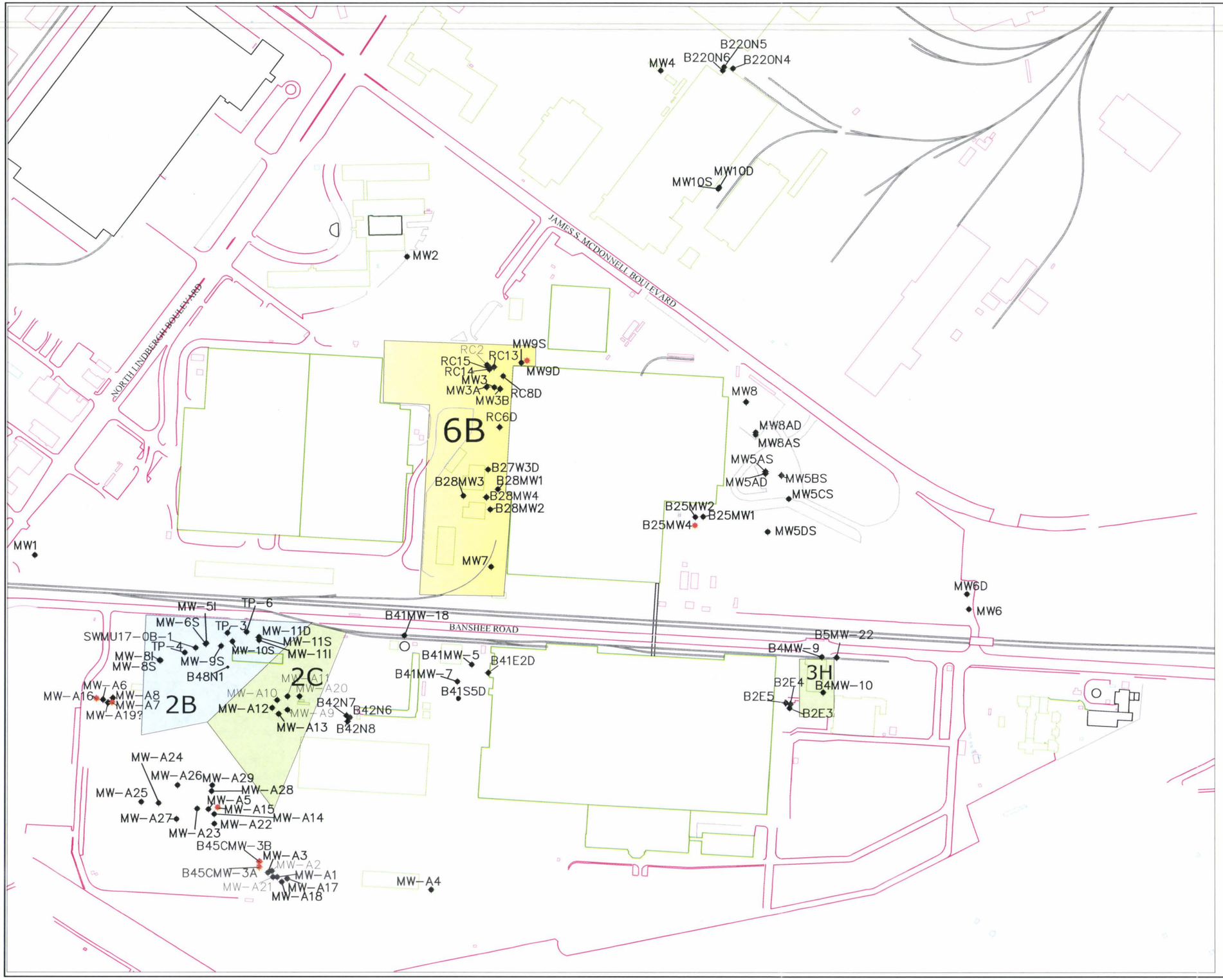
0 400

APPROX. SCALE (FEET)

RAM Group of Gannett Fleming, Inc.
5433 Westheimer, Suite 725, Houston, TX

Figure 1-3
Location of Monitoring Wells
(Shallow, Intermediate, and Deep Zones)
Boeing Tract 1
Hazelwood, Missouri

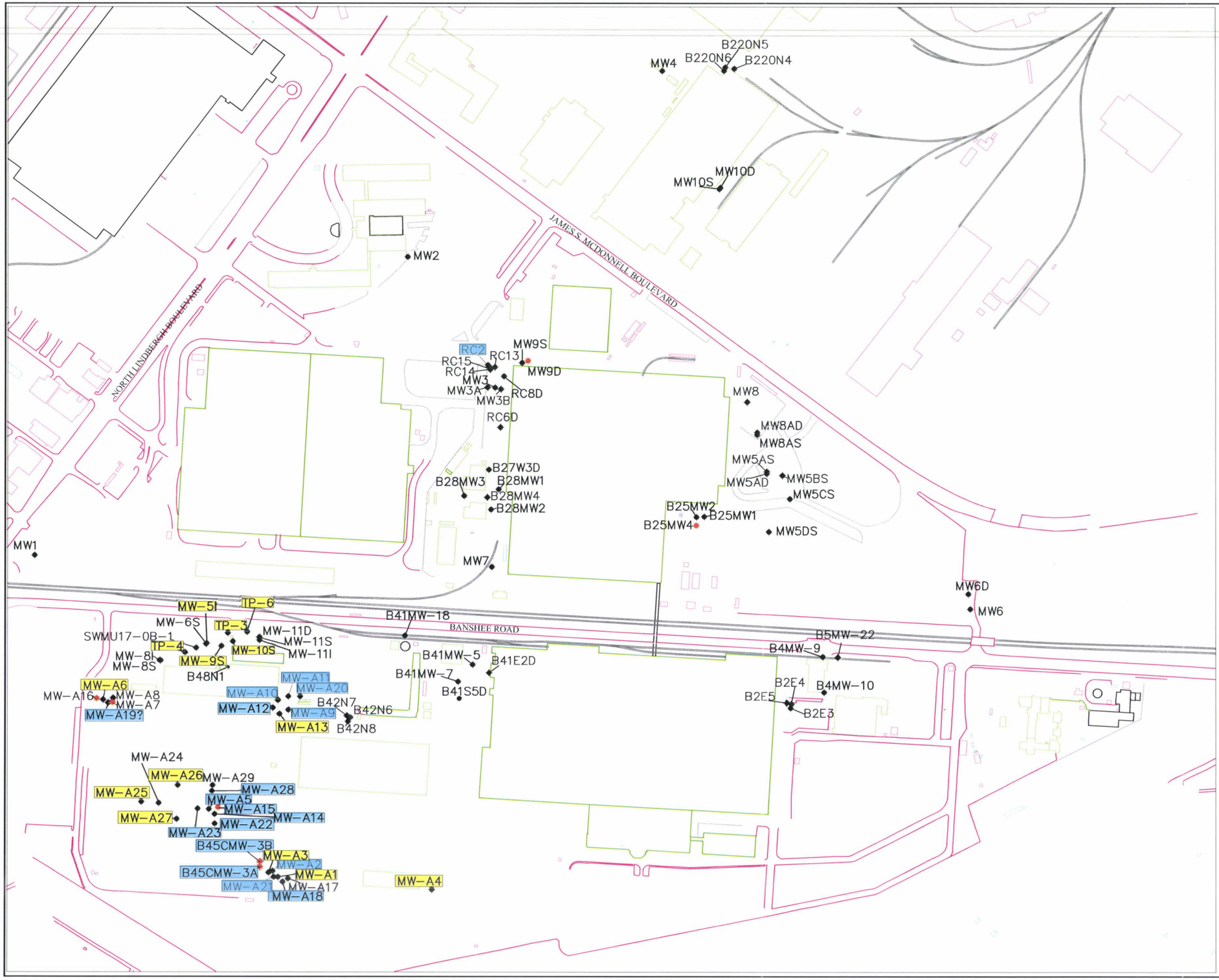
March 2011/DV | RAM Group (049992)



RAM Group of Gannett Fleming, Inc.
5433 Westheimer, Suite 725, Houston, TX

Figure 2-1
Sub-areas with Risk Exceedances
Boeing Tract 1, St Louis, MO

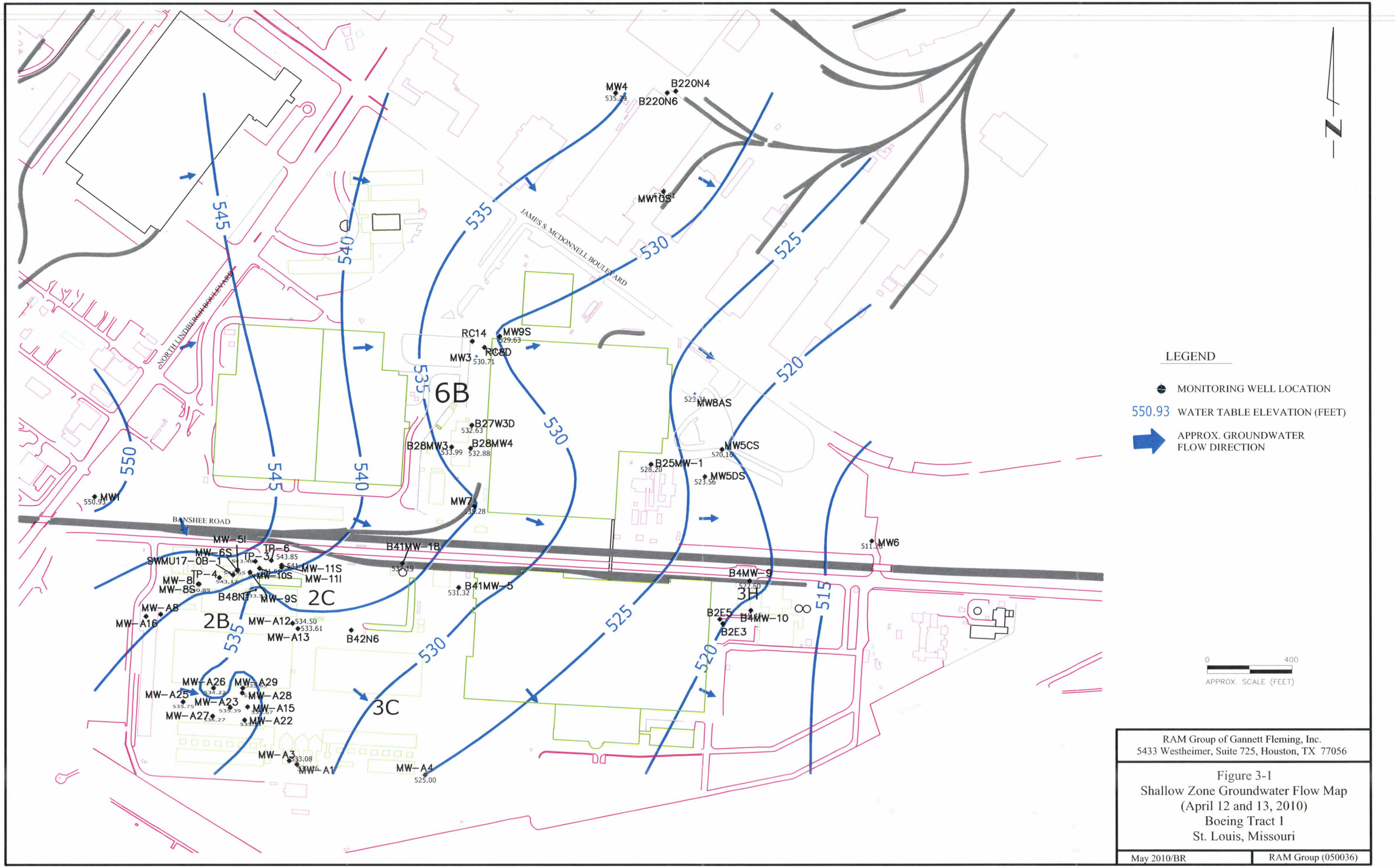
October 2010/BR | RAM Group (049992)



RAM Group of Gannett Fleming, Inc.
5433 Westheimer, Suite 725, Houston, TX

Figure 2-2
Location of Monitoring Wells with LNAPL
Boeing Tract 1
Hazelwood, Missouri

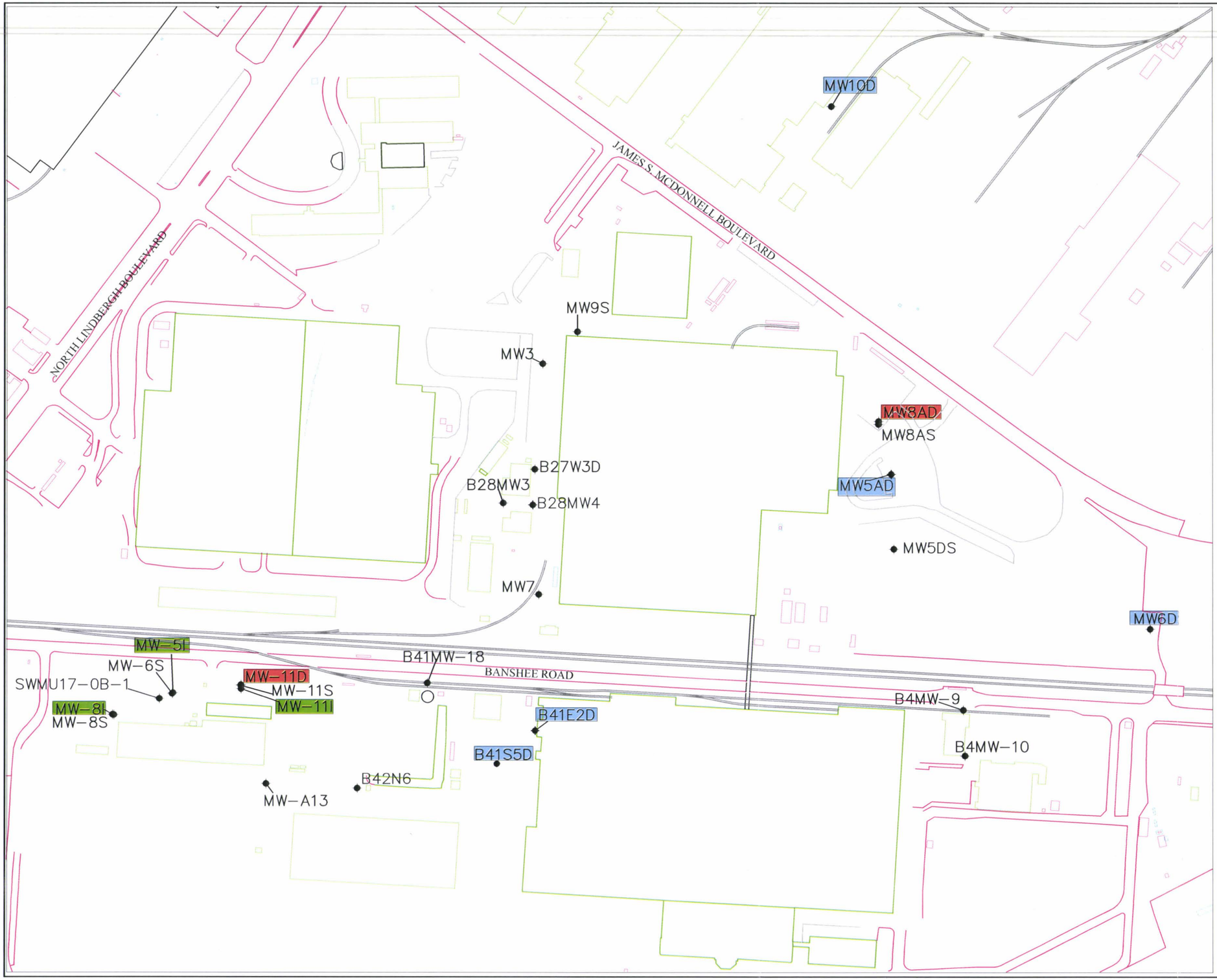
March 2011/DV | RAM Group (049992)



RAM Group of Gannett Fleming, Inc.
5433 Westheimer, Suite 725, Houston, TX 77056

Figure 3-1
Shallow Zone Groundwater Flow Map
(April 12 and 13, 2010)
Boeing Tract 1
St. Louis, Missouri

May 2010/BR | RAM Group (050036)



N

LEGEND

- Groundwater Monitoring Well
- Railroad
- Roadway
- Current Building Outline
- Deep Well
- Intermediate Well

Wells not highlighted are shallow wells

- Deep Well for Gauging Only

0 400

APPROX. SCALE (FEET)

RAM Group of Gannett Fleming, Inc.
5433 Westheimer, Suite 725, Houston, TX

Figure 6-1
Groundwater Monitoring Plan Wells
Boeing Tract 1
Hazelwood, Missouri

March 2011/DV | RAM Group (049992)

APPENDIX A

APPENDIX A
MDNR APPROVAL LETTER FOR CMS WORK PLAN

STATE OF MISSOURI Jeremiah W. (Jay) Nixon, Governor • Mark N. Templeton, Director
DEPARTMENT OF NATURAL RESOURCES
www.dnr.mo.gov

July 7, 2010

CERTIFIED MAIL –7009 0080 0000 1925 5442
RETURN RECEIPT REQUESTED

Mr. Joseph W. Haake
Group Manager
Environment Health and Safety
The Boeing Company
Department 107E, Building 111
Mail Code S111-2491
P.O. Box 516
St. Louis, MO 63166-0516

RE: Approval of Final Corrective Measures Study Work Plan Tract 1 Dated April 2010
The Boeing Company, Hazelwood, Missouri, EPA ID# MOD000818963

Dear Mr. Haake:

This letter is to notify you that the Missouri Department of Natural Resources' Hazardous Waste Program and the U.S. Environmental Protection Agency Region VII have completed review of the subject work plan.. This work plan was submitted by Boeing in accordance with the Hazelwood facility's Missouri Hazardous Waste Management Facility Part I Permit dated March 5, 1997. The Hazardous Waste Program and the Environmental Protection Agency hereby approve the subject work plan with the following comments and conditions.

Throughout the work plan, there are references to stabilizing the groundwater plume. While plume stabilization may be an interim goal, the ultimate goal of remediation should be to decrease the size of the plume and the contaminant concentrations within the plume.

Page 1-4, Section 1.2.3.2: This section concerns Sub-area 2B and dermal contact risks. Please note that in Table 2-1 there are other constituents of concern that present a dermal contact risk in Sub-area 6B.

The work plan includes a draft Missouri Environmental Covenant in Appendix D. While we had not expected to receive a fully developed draft of this environmental covenant until submission of the Corrective Measures Study (CMS) Report, we did note that the "Compliance Reporting" element has been lined out and recommended for elimination from the environmental covenant.

A notation is included as follows: "Propose to delete this requirement as unnecessary given the use limitations." We believe this item is a necessary part of this environmental covenant to the extent that it will be proposed as part of the preferred final remedy in the CMS Report. While our post-remedy selection regulatory oversight does include periodic review and inspection of remedy elements, we do not have the resources to routinely confirm that the proper documents remain in the property chain of title. We cannot visit the recorder's office and/or perform on-line verification of property recordings at the frequency that we would like. We have, on occasion, checked for such documents at other sites and discovered them to be absent after they were filed with the recorder. It has therefore been our practice to require annual verification by the owner/ operator that environmental covenants remain in place. Ultimately, we would like any environmental covenant to include this provision. The draft environmental covenant should be included in your CMS Report as part of the preferred final remedy.

If you have any questions regarding this letter, please contact Christine Kump-Mitchell, P.E., of my staff, at the Missouri Department of Natural Resources, 7545 South Lindbergh, Suite 210, St. Louis, MO 63125-4839, or by phone at (314) 416-2960 or 1-800-361-4827, or by e-mail at christine.kump@dnr.mo.gov. Thank you.

Sincerely,

HAZARDOUS WASTE PROGRAM

Richard A. Nussbaum, P.E., R.G.
Chief, Permits Section

RAN:bss

c: Ms. Joletta Golik, Environmental Manager, Lambert St. Louis International Airport
Ms. Christine Jump, Missouri State Coordinator, U.S. EPA Region VII
Ms. Amber Whisnant, Project Manager, U.S. EPA Region VII
St. Louis Regional Office, Missouri Department of Natural Resources

APPENDIX B

APPENDIX B
MDNR APPROVAL LETTER FOR RISK ASSESSMENT

STATE OF MISSOURI
Jeremiah W. (Jay) Nixon, Governor • Mark N. Templeton, Director
DEPARTMENT OF NATURAL RESOURCES
www.dnr.mo.gov

August 24, 2009

CERTIFIED MAIL – 7004 1160 0000 8177 3797
RETURN RECEIPT REQUESTED

Mr. Joseph W. Haake
Group Manager
Environmental and Hazardous
Materials Services
The Boeing Company
Department 107E, Building 111
Mail Code S111-2491
P.O. Box 516
St. Louis, MO 63166-0516

RE: Risk-Based Corrective Action Report, Boeing Tract 1 Dated September 2004
Addendums to Risk-Based Corrective Action Report Dated June 29, 2009, and
Dated July 29, 2009, The Boeing Company, Hazelwood, Missouri
EPA ID# MOD000818963

Dear Mr. Haake:

This letter is to notify you that the Missouri Department of Natural Resources and the U.S. Environmental Protection Agency Region VII (EPA) reviewed The Boeing Company's Risk-Based Corrective Action Report, Boeing Tract 1, dated September 2004 and associated addendums dated June 29, 2009 and July 29, 2009. The Boeing Company submitted these documents as required by McDonnell Douglas' (a wholly owned subsidiary of The Boeing Company) Missouri Hazardous Waste Management Facility Part I Permit, Schedule of Compliance, Condition II, dated March 5, 1997. We are approving these documents based on our review.

Based on the results of the Resource Conservation and Recovery Act Facility Investigation Report approved on December 22, 2004, the Risk-Based Corrective Action Report, Boeing Tract 1, dated September 2004 and associated addendums dated June 29 and July 29, 2009, and the EPA's Final Risk Assessment, Boeing Tract 1 Facility, dated March 2008, the agencies' request

Boeing progress to the next phase of the Corrective Action process and prepare a Corrective Measures Study (CMS) Work Plan in accordance with Section VII., CMS Work Plan of the Missouri Hazardous Waste Management Facility Part I Permit.

The CMS Work Plan shall be consistent with guidance contained in the EPA document entitled: RCRA Corrective Action Plan (Final), May 1994, OSWER Directive 9902.3-2A. The CMS Work Plan shall outline the general approach to investigating and evaluating potential remedies at the facility, including a description of all remedies that will be studied and a detailed description of any proposed pilot, laboratory, and/or bench scale studies.

Please submit the CMS Work Plan within 60 days of your receipt of this approval letter. Please submit three copies addressed to the Permits Section Chief, Hazardous Waste Program and two copies to Ms. Stephanie Doolan, at U.S. EPA Region VII at 901 North Fifth Street, Kansas City, KS 66101.

If you have any questions regarding this letter, please contact Christine Kump-Mitchell, P.E., of my staff, at the Missouri Department of Natural Resources, 7545 South Lindbergh, Suite 210, St. Louis, MO 63125-4839, or by phone at (314) 416-2960 or 1-800-361-4827, or by e-mail at christine.kump@dnr.mo.gov. Thank you.

Sincerely,

HAZARDOUS WASTE PROGRAM

Richard A. Nussbaum, P.E., R.G.
Chief, Permits Section

RAN:ckm

c: Ms. Stephanie Doolan, Project Manager, U.S. EPA Region VII
Ms. Joletta Golik, Environmental Manager, Lambert St. Louis International Airport
Ms. Christine Jump, Missouri State Coordinator, U.S. EPA Region VII
St. Louis Regional Office

APPENDIX C

APPENDIX C
UPDATE OF RISKS

APPENDIX C
UPDATE OF RISKS

Tables

Attachments

Tables for Updated Risks for Non-residential Worker and Construction Worker

C.1 INTRODUCTION

This appendix presents the updated risks for each area/sub-area and each receptor. The risks included in the RAM risk assessment report (RAM, 2004) were updated for the "factors" approved by MDNR and do not represent any changes not approved or agreed to by MDNR. Specifically, these factors include:

1. Changes in toxicity values and exposure factors,
2. Changes in TPH methodology, and
3. Changes in concentrations based on interim actions.

The effect of each of above factors on the risks and the combined effect of all the factors on the risks are presented in Tables C-1 and C-2 for non-residential worker and construction worker, respectively. In these tables, the second and seventh columns entitled "2004 Risk" present the cumulative carcinogenic and non-carcinogenic risks included in the RAM risk assessment, respectively.

Each of above three factors is discussed below.

C.2 CHANGES IN TOXICITY VALUES AND EXPSOURE FACTORS

As per the MDNR's request, e-mail dated July 6, 2009, the risks in the RAM risk assessment for each area/sub-area were recalculated using revised toxicity values and exposure factors. Two memos (RAM Group, 2009c,d) present the changes in exposure factors and toxicity values, and their impact on the calculated risks. Per MDNR's comments, the exposure factors changed only for the construction worker. Hence, the risks for construction worker were recalculated using the revised toxicity values and exposure factors. The risks for non-residential worker were recalculated using the revised toxicity values only since there was no change in the exposure factors.

The revised risks due to changes in toxicity values and exposure factors for each area/sub-area are tabulated in the third and eighth columns in Tables C-1 and C-2. As an example, with reference to Table C-1, for Sub-area 2B and non-residential worker the cumulative carcinogenic risk of 1.19E-5 includes the effect of changes in toxicity values only (all other factors same as the RAM risk assessment).

Similarly, with reference to Table C-2, for Sub-area 2B and construction worker the cumulative carcinogenic risk of 3.34E-4 is the revised carcinogenic risk for all COCs due to changes in toxicity values and exposure factors.

C.3 CHANGES IN TPH METHODOLOGY

As per the RAM Group (2010a), the changes in the TPH methodology affect the non-carcinogenic risks only because the TPH fractions are not considered carcinogenic. The primary change is the use of solubility limits for TPH concentrations that exceed the solubility limits.

This change affected the risks for (i) indoor inhalation of vapors from groundwater by the non-residential worker, and (ii) outdoor inhalation of vapors from groundwater by the construction worker.

For the area/sub-areas in which the recalculated cumulative risks in Section C.2 exceeded the target risk levels, the risks for indoor and outdoor inhalation of vapors from groundwater were recalculated as per the RAM Group (2010a).

The updated risks due to changes in TPH methodology are shown in the ninth column in Tables C-1 and C-2. With reference to Table C-1, for Sub-area 2B and non-residential worker the cumulative non-carcinogenic risk reduced from 96 to 0.72. Clearly, the representative concentrations used in the risk calculation significantly exceeded the solubility limits. With reference to Table C-2, for Sub-area 2B and construction worker the cumulative non-carcinogenic risk reduced from 11 to 4.6.

C.4 CHANGES IN CONCENTRATIONS BASED ON INTERIM ACTION

As an interim action, impacted soil was excavated in five sub-areas (2B, 3A, 3E, 6B, and 8B). Refer to Table C-3. These soil removal actions resulted in a change in the representative soil concentrations as presented in Table B-1 of the CMS Work Plan (RAM Group, 2010e) and included as Appendix B of this document.

The updated risks due to changes based on interim action are shown in the fifth and tenth columns in Tables C-1 and C-2. With reference to Table C-1, for Sub-area 2B and non-residential worker, the cumulative carcinogenic risk of 7.35E-6 is the updated risks due to changes based on interim action. With reference to Table C-2, for Sub-area 2B and construction worker the cumulative carcinogenic risk of 3.35E-4 is the update risks due to changes based on interim action.

C.5 FINAL UPDATED RISKS

The tables presenting the recalculated risks based on the combined effect of the three factors are presented as an attachment to this appendix. For ease of cross-reference with the RAM risk assessment, the numerical number of tables has been retained as in the RAM risk assessment. For example, Table 2-9(R) corresponds to Table 2-9(R) in the RAM risk assessment. The footers on this table are different (September 2004 vs. March 2011) and help distinguish the table.

The sixth and eleventh columns in Tables C-1 and C-2 present the recalculated risks based on the combined effect of the three factors. These risks are tabulated in Table 2-1 of this document as the revised risks and are used in the focused CMS.

Table C-1
Summary of Updated Risks Adjusted for Toxicity Values, TPH, and Interim Action for Non-residential Worker
Boeing Tract 1, St. Louis, Missouri

Area/ Sub-area	Non-residential Worker									
	IELCR					HI				
	2004 RA	Chagnes Due to			Final Risk	2004 RA	Chagnes Due to			Final Risk
		Toxicity	TPH	Interim Action			Toxicity	TPH	Interim Action	
Area 1 (Avg.)	N/A	N/A	---	---	N/A	N/A	N/A	---	---	N/A
Sub-area 2A	5.97E-08	3.63E-08	---	---	3.63E-08	**22**	**22**	0.052	---	0.052
Sub-area 2B	7.57E-06	1.19E-05	---	7.35E-06	7.35E-06	**96**	**96**	0.72	0.72	0.72
Sub-area 2C	2.02E-08	1.21E-08	---	---	1.21E-08	0.95	0.95	---	---	0.95
Sub-area 3A	7.90E-08	1.40E-08	---	1.44E-08	1.44E-08	**2.6**	**2.6**	0.017	0.017	0.017
Sub-area 3B	3.35E-09	2.01E-09	---	---	2.01E-09	0.31	0.31	---	---	0.31
Sub-area 3C	2.00E-08	1.20E-08	---	---	1.20E-08	**77**	**77**	0.033	---	0.033
Sub-area 3D	2.93E-08	1.25E-08	---	---	1.25E-08	0.075	0.075	---	---	0.075
Sub-area 3E	4.31E-08	2.60E-08	---	7.48E-09	7.48E-09	**10**	**10**	0.049	0.048	0.048
Sub-area 3F	NA	NA	---	---	NA	0.86	0.86	---	---	0.86
Sub-area 3G	6.02E-08	3.61E-08	---	---	3.61E-08	**2.8**	**2.8**	0.011	---	0.011
Sub-area 3H	NA	NA	---	---	NA	0.70	0.70	---	---	0.70
Area 4	2.17E-10	1.10E-10	---	---	1.10E-10	0.47	0.47	---	---	0.47
Area 5	NA	NA	---	---	NA	0.00053	0.00053	---	---	0.00053
Sub-area 6A	1.12E-10	6.73E-11	---	---	6.73E-11	0.054	0.054	---	---	0.054
Sub-area 6B	1.44E-06	1.92E-07	---	1.95E-07	1.95E-07	**7.9**	**7.9**	0.0063	0.0063	0.0063
Sub-area 6C	7.03E-08	2.33E-08	---	---	2.33E-08	**4.1**	**4.1**	0.0038	---	0.0038
Sub-area 6D	2.99E-10	3.08E-09	---	---	3.08E-09	0.00014	0.00014	---	---	0.00014
Area 7	N/A	N/A	---	---	N/A	N/A	N/A	---	---	N/A
Sub-area 8A	2.37E-08	9.39E-09	---	---	9.39E-09	0.00031	0.00004	---	---	0.00004
Sub-area 8B	NA	NA	---	---	NA	**55**	**55**	0.0029	---	0.0029
Sub-area 8C	NA	NA	---	---	NA	0.064	0.064	---	---	0.064
Area 9	1.79E-11	1.79E-11	---	---	1.79E-11	0.19	0.19	---	---	0.19

Notes:
Number in bold exceeds the cumulative acceptable target level.
IELCR: Individual excess lifetime cancer risk
HI: Hazard index
NA: Not available
N/A: Not applicable

Table C-2
Summary of Updated Risks Adjusted for Toxicity Values, Exposure Factors, TPH, and Interim Action for Construction Worker
Boeing Tract 1, St. Louis, Missouri

Area/ Sub-area	Construction Worker									
	IELCR					HI				
	2004 RA	Chagnes Due to			Final Risk	2004 RA	Chagnes Due to			Final Risk
		Toxicity and Exposure Factors	TPH	Interim Action			Toxicity and Exposure Factors	TPH	Interim Action	
Area 1 (Avg.)	1.87E-07	3.76E-07	---	---	3.76E-07	0.083	0.16	---	---	0.16
Sub-area 2A	3.52E-07	5.57E-07	---	---	5.57E-07	0.31	**1.6**	0.19	---	0.19
Sub-area 2B	1.89E-05	**3.36E-04**	---	**3.35E-04**	**3.35E-04**	**3.1**	**11**	**4.6**	**4.6**	**4.6**
Sub-area 2C	3.92E-08	9.89E-08	---	---	6.05E-08	0.047	0.15	---	---	0.15
Sub-area 3A	4.52E-08	6.05E-08	---	6.05E-08	6.05E-08	0.055	0.33	---	0.35	0.35
Sub-area 3B	4.66E-10	1.76E-09	---	---	1.76E-09	0.0071	0.039	---	---	0.039
Sub-area 3C	2.34E-08	5.88E-08	---	---	5.88E-08	**1.3**	**9.2**	0.047	---	0.047
Sub-area 3D	1.17E-07	2.71E-07	---	---	2.71E-07	0.048	0.066	---	---	0.066
Sub-area 3E	8.02E-10	3.02E-09	---	8.67E-10	8.67E-10	0.12	0.72	---	0.72	0.72
Sub-area 3F	NA	NA	---	---	NA	0.008	0.059	---	---	0.059
Sub-area 3G	9.38E-08	2.37E-07	---	---	2.37E-07	0.12	0.33	---	---	0.33
Sub-area 3H	6.35E-13	2.69E-12	---	---	2.69E-12	0.0058	0.040	---	---	0.040
Area 4	2.60E-06	5.40E-06	---	---	5.40E-06	0.014	0.042	---	---	0.042
Area 5	6.37E-08	8.17E-08	---	---	8.17E-08	0.013	0.022	---	---	0.022
Sub-area 6A	5.33E-08	6.85E-08	---	---	6.85E-08	0.0089	0.014	---	---	0.014
Sub-area 6B	2.44E-05	5.07E-05	---	5.07E-05	5.07E-05	0.17	0.90	---	0.90	0.90
Sub-area 6C	8.36E-08	1.18E-07	---	---	1.18E-07	0.060	0.21	---	---	0.21
Sub-area 6D	8.25E-08	2.95E-07	---	---	2.95E-07	0.013	0.018	---	---	0.018
Area 7	N/A	N/A	---	---	N/A	N/A	N/A	---	---	N/A
Sub-area 8A	1.02E-07	1.35E-07	---	---	1.35E-07	0.020	0.020	---	---	0.020
Sub-area 8B	3.74E-10	5.59E-10	---	5.59E-10	5.59E-10	0.49	**3.5**	0.00023	0.00023	0.00023
Sub-area 8C	1.25E-12	2.65E-11	---	---	2.65E-11	0.0052	0.017	---	---	0.017
Area 9	1.29E-11	9.03E-11	---	---	9.03E-11	0.0085	0.031	---	---	0.031

Notes:
Number in bold exceeds the cumulative acceptable target level.
IELCR: Individual excess lifetime cancer risk
HI: Hazard index
NA: Not available
N/A: Not applicable

Table C-3
Summary of Interim Action Remedial Excavations in 2005
Boeing Tract 1, Hazelwood, Missouri

Sub-area	Dimension of Excavated Area	Mass of Soil Excavated (tons)	Samples Excavated/Reference Table		Available Piezometers / Wells
Sub-area 2B	20 ft x 20 ft x 10 ft depth	2073.15 105.1 hazardous waste	B51I1 TP-1 (SB-1) TP-2 (SB-3) SB-4 TP-5 (SB-11) MW-7S (SB-14) SB-18	Table 3B-5(a) Table 3B-5(c) Table 3B-7(a) Table 3B-7(b) Table 3B-7(c)	MW-5I MW-6S MW-10S MW-11D MW-11I MW-11S TP-6 MW-8I MW-8S MW-9S
Sub-area 3A	11.5 ft x 9.5 ft x 8 ft depth	88.23	B42N5	Table 4A-5(a) Table 4A-5(b) Table 4A-5(c) Table 4A-7(a) Table 4A-7(b) Table 4A-7(c)	B42N6 B41MW-18
Sub-area 3E	7 ft x 8 ft x 4 ft depth	8.12	B2E2	Table 4E-7(a) Table 4E-7(b) Table 4E-7(c)	B2E3 B2E5
Sub-area 6B	15 ft x 15 ft x 6 ft depth	56.35	RC2 RC9	Table 7B-7(a) Table 7B-7(b) Table 7B-7(c) Table 7B-7(d) Table 7B-7(e)	RC14 MW3 MW7 MW9S B27W3D B28MW3 B28MW4
Sub-area 8B	10 ft x 10 ft x 5 ft depth	23.02	B220N1	Table 9B-8(b)	B220N4 B220N6 MW4

References:

Mactec, May 2006. Interim Action Remedial Excavation Completion Report, Boeing Tract 1, McDonnell Douglas, Hazelwood, Missouri.
Mactec, June 2006. Interim Measure Completion Report, Solid Waste Management Unit 17, McDonnell Douglas, Hazelwood, Missouri.

Table 3A-12(a)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker
Sub-area 2A: Demolished Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc.	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	(ug/L)	IELCR	HQ		
Benzene	443	1.62E-08	3.08E-04	220	1.95E-08	3.70E-04	3.58E-08	6.77E-04
Dichlorodifluoromethane	3.4	NA	5.11E-06	---	---	---	NA	5.11E-06
Ethylbenzene	376	NA	1.60E-06	---	---	---	NA	1.60E-06
Methylene chloride	2.9	1.80E-11	3.57E-08	---	---	---	1.80E-11	3.57E-08
Tetrachloroethene	10.6	5.00E-10	8.78E-07	---	---	---	5.00E-10	8.78E-07
Toluene	19	NA	3.95E-08	---	---	---	NA	3.95E-08
Xylenes, total	39	NA	1.29E-06	---	---	---	NA	1.29E-06
Organics Total Risk		**1.68E-08**	**3.17E-04**		**1.95E-08**	**3.70E-04**	**3.63E-08**	**6.86E-04**
TPH-GRO	12,428	NA	1.27E-04	70,830	NA	4.70E-02	NA	4.71E-02
TPH-DRO	118,086	NA	1.19E-04	22,344	NA	4.29E-03	NA	4.41E-03
TPH-ORO	2,500	NA	6.40E-08	6.6	NA	2.65E-06	NA	2.71E-06
TPH Total Risk		**NA**	**2.47E-04**		**NA**	**5.12E-02**	**NA**	**5.15E-02**
Arsenic	38,875	NA	NA	47	NA	NA	NA	NA
Cadmium	730	NA	NA	8.9	NA	NA	NA	NA
Mercury	49	NA	1.37E-04	---	---	---	NA	1.37E-04
Antimony	3,785	NA	NA	---	---	---	NA	NA
Beryllium	1,106	NA	NA	---	---	---	NA	NA
Cobalt	6,125	NA	NA	---	---	---	NA	NA
Copper	33,525	NA	NA	---	---	---	NA	NA
Nickel	15,750	NA	NA	---	---	---	NA	NA
Zinc	86,675	NA	NA	---	---	---	NA	NA
Metals Total Risk		**NA**	**1.37E-04**		**NA**	**NA**	**NA**	**1.37E-04**
CUMULATIVE RISK		**1.68E-08**	**7.01E-04**		**1.95E-08**	**5.16E-02**	**3.63E-08**	**5.23E-02**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter
GRO: Gasoline range organic
DRO: Diesel range organic
ORO: Oil range organic
TPH: Total petroleum hydrocarbon

Table 3B-12(a)

Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker

Sub-area 2B: Demolished Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc.	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	(ug/L)	IELCR	HQ		
1,1-Dichloroethene	---	---	---	150	5.95E-07	5.95E-02	5.95E-07	5.95E-02
1,2,3-Trimethylbenzene	---	---	---	48	NA	1.91E-04	NA	1.91E-04
1,2,4-Trimethylbenzene	---	---	---	182	NA	1.41E-03	NA	1.41E-03
Acetone	3,885	NA	4.39E-06	---	---	---	NA	4.39E-06
Benzene	---	---	---	239	2.12E-08	7.08E-04	2.12E-08	7.08E-04
Chloroethane	36	1.54E-09	5.13E-07	---	---	---	1.54E-09	5.13E-07
cis-1,2-Dichloroethene	283	NA	1.64E-04	4,497	NA	4.26E-03	NA	4.42E-03
Ethylbenzene	50	NA	2.13E-07	---	---	---	NA	2.13E-07
Isopropyl benzene	1,141	NA	1.11E-04	---	---	---	NA	1.11E-04
Methyl ethyl ketone (MEK)	1,638	NA	7.15E-07	---	---	---	NA	7.15E-07
Methylene chloride	505	3.13E-09	4.65E-05	---	---	---	3.13E-09	4.65E-05
Methyl tert-butyl ether (MTBE)	---	---	---	222	1.24E-10	4.76E-06	1.24E-10	4.76E-06
Naphthalene	11,032	NA	1.48E-04	321	NA	3.95E-04	NA	5.43E-04
n-Butylbenzene	2,168	NA	1.46E-05	221	NA	1.48E-04	NA	1.63E-04
n-Propylbenzene	1,811	NA	3.66E-05	189	NA	1.03E-04	NA	1.39E-04
p-Isopropyltoluene	442	NA	3.36E-07	---	---	---	NA	3.36E-07
sec-Butylbenzene	2,093	NA	2.56E-05	207	NA	1.94E-04	NA	2.20E-04
Tetrachloroethene	16,500	7.77E-07	1.37E-03	19,115	5.06E-06	7.37E-02	5.84E-06	7.51E-02
Toluene	505	NA	1.05E-06	649	NA	9.32E-06	NA	1.04E-05
trans-1,2-Dichloroethene	82	NA	3.59E-05	150	NA	1.43E-04	NA	1.79E-04
Trichloroethene	128	1.19E-09	4.67E-06	1,991	1.15E-07	9.58E-04	1.16E-07	9.62E-04
Vinyl chloride	245	2.22E-07	7.27E-04	728	5.55E-07	5.55E-01	7.77E-07	5.56E-01
Xylenes, Total	352	NA	1.16E-05	---	---	---	NA	1.16E-05
Organics Total Risk		**1.00E-06**	**2.70E-03**		**6.35E-06**	**6.97E-01**	**7.35E-06**	**7.00E-01**
Aliphatics > nC6 to nC8 (TX1006)	---	---	---	4.66E+03	NA	2.72E-03	NA	2.72E-03
Aliphatics > nC8 to nC10 (TX1006)	---	---	---	4.30E+02	NA	7.39E-03	NA	7.39E-03
Aromatics > nC8 to nC10 (TX1006)	---	---	---	2.73E+03	NA	1.53E-03	NA	1.53E-03
TPH-GRO	**58,214**	**NA**	**5.96E-04**	**7.82E+03**	**NA**	**1.16E-02**	**NA**	**1.22E-02**
Aliphatics > nC10 to nC12 (TX1006)	---	---	---	3.40E+01	NA	8.77E-04	NA	8.77E-04
Aliphatics > nC12 to nC16 (TX1006)	---	---	---	7.60E-01	NA	8.49E-05	NA	8.49E-05
Aliphatics > nC16 to nC21 (TX1006)	---	---	---	2.50E-03	NA	2.63E-06	NA	2.63E-06
Aromatics > nC10 to nC12 (TX1006)	---	---	---	8.11E+03	NA	1.47E-03	NA	1.47E-03
Aromatics > nC12 to nC16 (TX1006)	---	---	---	5.80E+03	NA	4.38E-04	NA	4.38E-04
Aromatics > nC16 to nC21 (TX1006)	---	---	---	6.50E+02	NA	1.37E-05	NA	1.37E-05
TPH-DRO	**817,829**	**NA**	**8.26E-04**	**1.46E+04**	**NA**	**2.88E-03**	**NA**	**3.71E-03**
Aliphatics > nC21 to nC35 (TX1006)	---	---	---	2.50E-03	NA	2.63E-06	NA	2.63E-06
Aromatics > nC21 to nC35 (TX1006)	---	---	---	6.60E+00	NA	1.61E-08	NA	1.61E-08
TPH-ORO	**40,250**	**NA**	**1.03E-06**	**6.60E+00**	**NA**	**2.65E-06**	**NA**	**3.68E-06**
TPH Total Risk		**NA**	**1.42E-03**		**NA**	**1.45E-02**	**NA**	**1.60E-02**
Arsenic	11,546	NA	NA	67	NA	NA	NA	NA
Cadmium	1,638	NA	NA	4.0	NA	NA	NA	NA
Chromium	25,878	NA	NA	---	---	---	NA	NA
Mercury	114	NA	3.22E-04	---	---	---	NA	3.22E-04
Selenium	1,003	NA	NA	---	---	---	NA	NA
Silver	1,289	NA	NA	---	---	---	NA	NA
Antimony	2,513	NA	NA	---	---	---	NA	NA
Beryllium	849	NA	NA	---	---	---	NA	NA
Cobalt	6,613	NA	NA	---	---	---	NA	NA
Copper	11,748	NA	NA	---	---	---	NA	NA
Manganese	844,250	NA	NA	---	---	---	NA	NA
Nickel	17,715	NA	NA	---	---	---	NA	NA
Thallium	2,039	NA	NA	---	---	---	NA	NA
Zinc	36,425	NA	NA	---	---	---	NA	NA
Metals Total Risk		**NA**	**3.22E-04**		**NA**	**NA**	**NA**	**3.22E-04**
CUMULATIVE RISK		**1.00E-06**	**4.44E-03**		**6.35E-06**	**7.12E-01**	**7.35E-06**	**7.16E-01**

Notes:

NA: Not available

---: Risk evaluation was not performed.

HI: Hazard index

ug/kg: Micrograms per kilogram

ug/L: Micrograms per liter

GRO: Gasoline range organic

DRO: Diesel range organic

ORO: Oil range organic

TPH: Total petroleum hydrocarbon

Table 3C-12(a)

Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker

Sub-area 2C: Demolished Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc.	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	(ug/L)	IELCR	HQ		
Benzene	---	---	---	203	1.21E-08	4.04E-04	1.21E-08	4.04E-04
Organics Total Risk		**NA**	**NA**		**1.21E-08**	**4.04E-04**	**1.21E-08**	**4.04E-04**
TPH-GRO	13,000	NA	1.33E-04	73,658	NA	5.20E-01	NA	5.20E-01
TPH-DRO	1,330,000	NA	1.34E-03	513	NA	1.18E-01	NA	1.19E-01
TPH-ORO	34,000	NA	8.69E-07	429	NA	2.61E-01	NA	3.12E-01
TPH Total Risk		**NA**	**1.48E-03**		**NA**	**8.99E-01**	**NA**	**9.52E-01**
CUMULATIVE RISK		**NA**	**1.48E-03**		**1.21E-08**	**8.99E-01**	**1.21E-08**	**9.52E-01**

Notes:

NA: Not available

---: Risk evaluation was not performed.

HI: Hazard index

ug/kg: Micrograms per kilogram

ug/L: Micrograms per liter

GRO: Gasoline range organic

DRO: Diesel range organic

ORO: Oil range organic

TPH: Total petroleum hydrocarbon

Table 4A-10(a)

Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker

Sub-area 3A: Retained Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc. (ug/L)	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ		IELCR	HQ		
1,2,4-Trimethylbenzene	26	NA	1.47E-06	7.8	NA	6.86E-05	NA	7.01E-05
1,3,5-Trimethylbenzene	73	NA	2.62E-05	---	---	---	NA	2.62E-05
Benzene	15	5.48E-10	1.04E-05	69	6.92E-09	2.31E-04	7.47E-09	2.41E-04
cis-1,2-Dichloroethene	---	---	---	381	NA	3.97E-04	NA	3.97E-04
Ethylbenzene	12.7	NA	5.40E-08	---	---	---	NA	5.40E-08
Isopropylbenzene	19	NA	1.84E-06	---	---	---	NA	1.84E-06
m,p-Xylene	15	NA	2.42E-07	---	---	---	NA	2.42E-07
Methylene chloride	44.3	2.75E-10	4.09E-06	---	---	---	2.75E-10	4.09E-06
n-Propylbenzene	---	---	---	71	NA	4.47E-05	NA	4.47E-05
p-Isopropyltoluene	63	NA	4.79E-08	---	---	---	NA	4.79E-08
Toluene	51	NA	1.07E-07	---	---	---	NA	1.07E-07
Vinyl chloride	---	---	---	7.3	6.68E-09	6.68E-03	6.68E-09	6.68E-03
Xylenes, Total	40.9	NA	1.35E-06	---	---	---	NA	1.35E-06
Organics Total Risk		**8.23E-10**	**4.58E-05**		**1.36E-08**	**7.43E-03**	**1.44E-08**	**7.47E-03**
TPH-GRO	---	---	---	1,060	NA	7.83E-03	NA	7.83E-03
TPH-DRO	24,000	NA	1.54E-05	3,012	NA	1.51E-03	NA	1.52E-03
TPH-ORO	4,500	NA	1.15E-07	6.6	NA	3.20E-06	NA	3.32E-06
TPH Total Risk		**NA**	**1.56E-05**		**NA**	**9.35E-03**	**NA**	**9.36E-03**
Arsenic	---	---	---	100	NA	NA	NA	NA
Metals Total Risk		**NA**	**NA**		**NA**	**NA**	**NA**	**NA**
CUMULATIVE RISK		**8.23E-10**	**6.13E-05**		**1.36E-08**	**1.68E-02**	**1.44E-08**	**1.68E-02**

Notes:

NA: Not available

---: Risk evaluation was not performed.

HI: Hazard index

TPH: Total petroleum hydrocarbon

DRO: Diesel range organic

GRO: Gasoline range organic

ORO: Oil range organic

ug/kg: Micrograms per kilogram

ug/L: Micrograms per liter

Table 4B-10(a)

Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker

Sub-area 3B: Retained Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc. (ug/kg)	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc. (ug/L)	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
		IELCR	HQ		IELCR	HQ		
Acetone	19	NA	2.15E-08	---	---	---	NA	2.15E-08
Benzene	55	2.01E-09	3.81E-05	---	---	---	2.01E-09	3.81E-05
Carbon disulfide	3.0	NA	6.85E-07	---	---	---	NA	6.85E-07
Ethylbenzene	14	NA	6.07E-08	---	---	---	NA	6.07E-08
Isopropylbenzene	4.0	NA	3.90E-07	---	---	---	NA	3.90E-07
n-Propylbenzene	2.9	NA	5.88E-08	6.1	NA	3.84E-06	NA	3.90E-06
sec-Butylbenzene	5.7	NA	6.99E-08	---	---	---	NA	6.99E-08
Toluene	5.6	NA	1.16E-08	---	---	---	NA	1.16E-08
Xylenes, Total	58	NA	1.91E-06	---	---	---	NA	1.91E-06
Organics Total Risk		**2.01E-09**	**4.13E-05**		**NA**	**3.84E-06**	**2.01E-09**	**4.51E-05**
Aliphatics > nC6 to nC8 (TX1006)	---	---	---	2,219	NA	1.57E-03	NA	1.57E-03
Aliphatics > nC8 to nC10 (TX1006)	---	---	---	555	NA	1.15E-02	NA	1.15E-02
Aromatics > nC8 to nC10 (TX1006)	---	---	---	555	NA	3.63E-04	NA	3.63E-04
TPH-GRO	**29,200**	**NA**	**2.99E-04**	**3,328**	**NA**	**1.35E-02**	**NA**	**1.38E-02**
Aliphatics > nC10 to nC12 (TX1006)	---	---	---	88	NA	2.75E-03	NA	2.75E-03
Aliphatics > nC12 to nC16 (TX1006)	---	---	---	88	NA	1.19E-02	NA	1.19E-02
Aliphatics > nC16 to nC21 (TX1006)	---	---	---	88	NA	1.12E-01	NA	1.12E-01
Aromatics > nC10 to nC12 (TX1006)	---	---	---	88	NA	1.78E-05	NA	1.78E-05
Aromatics > nC12 to nC16 (TX1006)	---	---	---	88	NA	7.08E-06	NA	7.08E-06
Aromatics > nC16 to nC21 (TX1006)	---	---	---	88	NA	1.89E-06	NA	1.89E-06
TPH-DRO	**2,081**	**NA**	**2.11E-06**	**529**	**NA**	**1.27E-01**	**NA**	**1.27E-01**
Aliphatics > nC21 to nC35 (TX1006)	---	---	---	136	NA	1.73E-01	NA	1.73E-01
Aromatics > nC21 to nC35 (TX1006)	---	---	---	136	NA	3.31E-07	NA	3.31E-07
TPH-ORO	**3,121**	**NA**	**7.99E-08**	**271**	**NA**	**1.73E-01**	**NA**	**1.73E-01**
TPH Total Risk		**NA**	**3.02E-04**		**NA**	**3.13E-01**	**NA**	**3.13E-01**
CUMULATIVE RISK		**2.01E-09**	**3.43E-04**		**NA**	**3.13E-01**	**2.01E-09**	**3.14E-01**

Notes:

NA: Not available

---: Risk evaluation was not performed.

HI: Hazard index

TPH: Total petroleum hydrocarbon

DRO: Diesel range organic

GRO: Gasoline range organic

ORO: Oil range organic

ug/kg: Micrograms per kilogram

ug/L: Micrograms per liter

Table 4C-10(a)

Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker

Sub-area 3C: Retained Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc. (ug/L)	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ		IELCR	HQ		
Benzene	---	---	---	120	1.20E-08	4.01E-04	1.20E-08	4.01E-04
Methyl tert-butyl ether	---	---	---	35	2.00E-11	7.68E-07	2.00E-11	7.68E-07
n-Butylbenzene	---	---	---	208	NA	1.63E-04	NA	1.63E-04
n-Propylbenzene	---	---	---	223	NA	1.40E-04	NA	1.40E-04
sec-Butylbenzene	---	---	---	172	NA	1.91E-04	NA	1.91E-04
Organics Total Risk		**NA**	**NA**		**1.20E-08**	**8.95E-04**	**1.20E-08**	**8.95E-04**
TPH-GRO	---	---	---	24,847	NA	2.52E-02	NA	2.52E-02
TPH-DRO	---	---	---	31,485	NA	6.68E-03	NA	6.68E-03
TPH-ORO	---	---	---	6.6	NA	3.20E-06	NA	3.20E-06
TPH Total Risk		**NA**	**NA**		**NA**	**3.19E-02**	**NA**	**3.19E-02**
CUMULATIVE RISK		**NA**	**NA**		**1.20E-08**	**3.28E-02**	**1.20E-08**	**3.28E-02**

Notes:

NA: Not available

---: Risk evaluation was not performed.

HI: Hazard index

TPH: Total petroleum hydrocarbon

DRO: Diesel range organic

GRO: Gasoline range organic

ORO: Oil range organic

ug/kg: Micrograms per kilogram

ug/L: Micrograms per liter

Table 4D-10(a)

Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker
Sub-area 3D: Retained Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc. (ug/kg)	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc. (ug/L)	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
		IELCR	HQ		IELCR	HQ		
1,1-Dichloroethene	---	---	---	2.6	8.83E-09	8.83E-04	8.83E-09	8.83E-04
1,2,4-Trimethylbenzene	15,668	NA	3.20E-05	---	---	---	NA	3.20E-05
1,3,5-Trimethylbenzene	18	NA	2.38E-07	---	---	---	NA	2.38E-07
Benzene	11	1.44E-11	2.72E-07	2.1	1.46E-10	4.86E-06	1.60E-10	5.13E-06
Chloroethane	3.6	5.61E-12	1.87E-09	---	---	---	5.61E-12	1.87E-09
Isopropylbenzene	16	NA	5.59E-08	---	---	---	NA	5.59E-08
m,p-Xylene	21	NA	1.24E-08	---	---	---	NA	1.24E-08
n-Butylbenzene	7.3	NA	1.25E-08	---	---	---	NA	1.25E-08
n-Propylbenzene	15	NA	1.12E-08	---	---	---	NA	1.12E-08
o-Xylene	6.3	NA	4.00E-11	---	---	---	NA	4.00E-11
p-Isopropyltoluene	18	NA	5.06E-10	---	---	---	NA	5.06E-10
sec-Butylbenzene	64	NA	2.84E-08	---	---	---	NA	2.84E-08
tert-Butylbenzene	18	NA	5.35E-09	---	---	---	NA	5.35E-09
Tetrachloroethene	5.3	9.09E-12	1.60E-08	6.2	1.37E-09	2.00E-05	1.38E-09	2.00E-05
Trichloroethene	---	---	---	3.3	1.56E-10	1.30E-06	1.56E-10	1.30E-06
Vinyl chloride	---	---	---	2.9	1.99E-09	1.99E-03	1.99E-09	1.99E-03
Xylenes, Total	12	NA	1.44E-08	---	---	---	NA	1.44E-08
Organics Total Risk		**2.91E-11**	**3.26E-05**		**1.25E-08**	**2.90E-03**	**1.25E-08**	**2.93E-03**
TPH-GRO	500	NA	1.86E-07	500	NA	2.72E-03	NA	2.72E-03
TPH-DRO	24,770	NA	9.12E-07	190	NA	3.36E-02	NA	3.36E-02
TPH-ORO	5,610	NA	5.22E-09	75	NA	3.52E-02	NA	3.52E-02
TPH Total Risk		**NA**	**1.10E-06**		**NA**	**7.16E-02**	**NA**	**7.16E-02**
Arsenic	9,700	NA	NA	25	NA	NA	NA	NA
Barium	---	---	---	1,978	NA	NA	NA	NA
Beryllium	470	NA	NA	---	---	---	NA	NA
Cadmium	412	NA	NA	8.2	NA	NA	NA	NA
Chromium	---	---	---	67	NA	NA	NA	NA
Copper	13,317	NA	NA	---	---	---	NA	NA
Manganese	---	---	---	2,156	NA	NA	NA	NA
Nickel	12,247	NA	NA	---	---	---	NA	NA
Selenium	2,336	NA	NA	---	---	---	NA	NA
Thallium	5,967	NA	NA	---	---	---	NA	NA
Zinc	39,892	NA	NA	---	---	---	NA	NA
Metals Total Risk		**NA**	**NA**		**NA**	**NA**	**NA**	**NA**
CUMULATIVE RISK		**2.91E-11**	**3.37E-05**		**1.25E-08**	**7.45E-02**	**1.25E-08**	**7.45E-02**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
DRO: Diesel range organic
GRO: Gasoline range organic
ORO: Oil range organic
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter

Table 4E-10(a)

Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker
Sub-area 3E: Retained Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc. (ug/L)	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ		IELCR	HQ		
1,2,4-Trimethylbenzene	---	---	---	2,500	NA	1.93E-02	NA	1.93E-02
Acetone	68	NA	7.66E-08	540	NA	1.43E-07	NA	2.19E-07
Benzene	202	7.39E-09	1.40E-04	---	---	---	7.39E-09	1.40E-04
Ethylbenzene	725	NA	3.07E-06	1,245	NA	7.12E-05	NA	7.42E-05
Isopropylbenzene	140	NA	1.36E-05	---	---	---	NA	1.36E-05
Methyl tert-butyl ether	39	3.05E-11	1.09E-07	---	---	---	3.05E-11	1.09E-07
Methylene chloride	10	6.19E-11	1.23E-07	---	---	---	6.19E-11	1.23E-07
m,p-Xylene	---	---	---	5,300	NA	6.41E-04	NA	6.41E-04
Naphthalene	206	NA	2.75E-06	930	NA	1.14E-03	NA	1.14E-03
n-Butylbenzene	131	NA	8.82E-07	---	---	---	NA	8.82E-07
n-Propylbenzene	453	NA	9.15E-06	380	NA	2.05E-04	NA	2.15E-04
sec-Butylbenzene	52	NA	6.35E-07	---	---	---	NA	6.35E-07
Toluene	115	NA	2.38E-07	---	---	---	NA	2.38E-07
Xylenes, total	1533	NA	5.04E-05	---	---	---	NA	5.04E-05
Organics Total Risk		**7.48E-09**	**2.21E-04**		**NA**	**2.14E-02**	**7.48E-09**	**2.16E-02**
Aliphatics > nC6 to nC8 (TX1006)	---	---	---	4.92E+03	NA	2.87E-03	NA	2.87E-03
Aliphatics > nC8 to nC10 (TX1006)	---	---	---	4.30E+02	NA	7.37E-03	NA	7.37E-03
Aromatics > nC8 to nC10 (TX1006)	---	---	---	1.97E+04	NA	1.10E-02	NA	1.10E-02
TPH-GRO	**180,057**	**NA**	**1.84E-03**	**2.50E+04**	**NA**	**2.12E-02**	**NA**	**2.31E-02**
Aliphatics > nC10 to nC12 (TX1006)	---	---	---	3.40E+01	NA	8.74E-04	NA	8.74E-04
Aliphatics > nC12 to nC16 (TX1006)	---	---	---	7.60E-01	NA	8.47E-05	NA	8.47E-05
Aliphatics > nC16 to nC21 (TX1006)	---	---	---	2.50E-03	NA	2.62E-06	NA	2.62E-06
Aromatics > nC10 to nC12 (TX1006)	---	---	---	8.34E+03	NA	1.51E-03	NA	1.51E-03
Aromatics > nC12 to nC16 (TX1006)	---	---	---	5.80E+03	NA	4.37E-04	NA	4.37E-04
Aromatics > nC16 to nC21 (TX1006)	---	---	---	6.50E+02	NA	1.36E-05	NA	1.36E-05
TPH-DRO	**5,304**	**NA**	**5.35E-06**	**1.48E+04**	**NA**	**2.92E-03**	**NA**	**2.92E-03**
Aliphatics > nC21 to nC35 (TX1006)	---	---	---	2.50E-03	NA	2.62E-06	NA	2.62E-06
Aromatics > nC21 to nC35 (TX1006)	---	---	---	6.60E+00	NA	1.60E-08	NA	1.60E-08
TPH-ORO	**5,455**	**NA**	**1.39E-07**	**6.60E+00**	**NA**	**2.64E-06**	**NA**	**2.78E-06**
TPH Total Risk		**NA**	**1.84E-03**		**NA**	**2.41E-02**	**NA**	**2.60E-02**
CUMULATIVE RISK		**7.48E-09**	**2.06E-03**		**NA**	**4.55E-02**	**7.48E-09**	**4.76E-02**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
DRO: Diesel range organic
GRO: Gasoline range organic
ORO: Oil range organic
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter

Table 4F-10(a)

Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker
Sub-area 3F: Retained Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc. (ug/kg)	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc. (ug/L)	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
		IELCR	HQ		IELCR	HQ		
TPH-GRO	---	---	---	500	NA	2.86E-03	NA	2.86E-03
TPH-DRO	---	---	---	514	NA	9.57E-02	NA	9.57E-02
TPH-ORO	---	---	---	1,543	NA	7.62E-01	NA	7.62E-01
TPH Total Risk		**NA**	**NA**		**NA**	**8.61E-01**	**NA**	**8.61E-01**
CUMULATIVE RISK		**NA**	**NA**		**NA**	**8.61E-01**	**NA**	**8.61E-01**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
DRO: Diesel range organic
GRO: Gasoline range organic
ORO: Oil range organic
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter

Table 4G-10(a)

Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker
Sub-area 3G: Retained Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc. (ug/L)	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ		IELCR	HQ		
1,2,4-Trimethylbenzene	840	NA	2.72E-06	5.5	NA	3.55E-05	NA	3.82E-05
1,3,5-Trimethylbenzene	326	NA	6.74E-06	---	---	---	NA	6.74E-06
Acetone	820	NA	5.35E-08	---	---	---	NA	5.35E-08
Benzene	548	1.16E-09	2.20E-05	484	3.49E-08	1.16E-03	3.61E-08	1.19E-03
Ethylbenzene	1,010	NA	2.48E-07	---	---	---	NA	2.48E-07
m,p-Xylene	2,650	NA	2.51E-06	---	---	---	NA	2.51E-06
Methyl tert-butyl ether	378	1.71E-11	6.11E-08	---	---	---	1.71E-11	6.11E-08
Naphthalene	478	NA	3.69E-07	---	---	---	NA	3.69E-07
o-Xylene	1,490	NA	1.51E-08	---	---	---	NA	1.51E-08
p-Isopropyltoluene	416	NA	1.83E-08	---	---	---	NA	1.83E-08
Toluene	5,700	NA	6.84E-07	---	---	---	NA	6.84E-07
Xylenes, Total	3,550	NA	6.75E-06	---	---	---	NA	6.75E-06
Organics Total Risk		**1.18E-09**	**4.21E-05**		**3.49E-08**	**1.20E-03**	**3.61E-08**	**1.24E-03**
Aliphatics > nC6 to nC8 (TX1006)	---	---	---	1.68E+03	NA	9.22E-04	NA	9.22E-04
Aliphatics > nC8 to nC10 (TX1006)	---	---	---	4.30E+02	NA	6.94E-03	NA	6.94E-03
Aromatics > nC8 to nC10 (TX1006)	---	---	---	1.68E+03	NA	8.17E-04	NA	8.17E-04
TPH-GRO	**3,280**	**NA**	**1.94E-06**	**3.79E+03**	**NA**	**8.68E-03**	**NA**	**8.68E-03**
Aliphatics > nC10 to nC12 (TX1006)	---	---	---	3.40E+01	NA	8.23E-04	NA	8.23E-04
Aliphatics > nC12 to nC16 (TX1006)	---	---	---	7.60E-01	NA	7.97E-05	NA	7.97E-05
Aliphatics > nC16 to nC21 (TX1006)	---	---	---	2.50E-03	NA	2.47E-06	NA	2.47E-06
Aromatics > nC10 to nC12 (TX1006)	---	---	---	2.22E+02	NA	3.17E-05	NA	3.17E-05
Aromatics > nC12 to nC16 (TX1006)	---	---	---	2.22E+02	NA	1.21E-05	NA	1.21E-05
Aromatics > nC16 to nC21 (TX1006)	---	---	---	2.22E+02	NA	3.12E-06	NA	3.12E-06
TPH-DRO	**85,750**	**NA**	**5.00E-06**	**7.01E+02**	**NA**	**9.52E-04**	**NA**	**9.57E-04**
Aliphatics > nC21 to nC35 (TX1006)	---	---	---	2.50E-03	NA	2.47E-06	NA	2.47E-06
Aromatics > nC21 to nC35 (TX1006)	---	---	---	6.60E+00	NA	1.04E-08	NA	1.04E-08
TPH-ORO	**1,470,000**	**NA**	**2.17E-06**	**6.60E+00**	**NA**	**2.48E-06**	**NA**	**4.65E-06**
TPH Total Risk		**NA**	**9.11E-06**		**NA**	**9.63E-03**	**NA**	**9.64E-03**
CUMULATIVE RISK		**NA**	**5.12E-05**		**3.49E-08**	**1.08E-02**	**3.61E-08**	**1.09E-02**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
DRO: Diesel range organic
GRO: Gasoline range organic
ORO: Oil range organic
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter

Table 4H-10(a)

Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker

Sub-area 3H: Retained Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc. (ug/kg)	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc. (ug/L)	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
		IELCR	HQ		IELCR	HQ		
TPH-GRO	---	---	---	275	NA	6.42E-04	NA	6.42E-04
TPH-DRO	---	---	---	2,520	NA	5.74E-01	NA	5.74E-01
TPH-ORO	---	---	---	213	NA	1.29E-01	NA	1.29E-01
TPH Total Risk		**NA**	**NA**		**NA**	**7.04E-01**	**NA**	**7.04E-01**
Arsenic	---	---	---	80	NA	NA	NA	NA
Manganese	---	---	---	8,860	NA	NA	NA	NA
Metals Total Risk		**NA**	**NA**		**NA**	**NA**	**NA**	**NA**
CUMULATIVE RISK		**NA**	**NA**		**NA**	**7.04E-01**	**NA**	**7.04E-01**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
DRO: Diesel range organic
GRO: Gasoline range organic
ORO: Oil range organic
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter

Table 5-9(a)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker
Area 4: Power Plant, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc. (ug/L)	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ		IELCR	HQ		
Acetone	23	NA	1.40E-09	---	---	---	NA	1.40E-09
Methyl ethyl ketone (MEK)	5.1	NA	1.19E-10	---	---	---	NA	1.19E-10
Methylene chloride	2.7	8.90E-13	1.32E-08	---	---	---	8.90E-13	1.32E-08
Toluene	2.8	NA	3.15E-10	---	---	---	NA	3.15E-10
Anthrathene	3.0	NA	3.49E-13	---	---	---	NA	3.49E-13
Benzo(a)anthracene	5.1	1.46E-16	NA	5.5	3.99E-11	7.98E-06	3.99E-11	7.98E-06
Benzo(a)pyrene	7.5	7.95E-16	NA	---	---	---	7.95E-16	NA
Benzo(b)fluoranthene	28	4.61E-16	NA	5.4	6.74E-11	1.35E-05	6.74E-11	1.35E-05
Benzo(g,h,i)perylene	13	NA	1.44E-13	---	---	---	NA	1.44E-13
Benzo(k)fluoranthene	2.8	1.58E-17	NA	---	---	---	1.58E-17	NA
Chrysene	7.1	3.78E-17	NA	---	---	---	3.78E-17	NA
Dibenzo(a,h)anthracene	35	6.67E-16	NA	---	---	---	6.67E-16	NA
Fluoranthene	11	NA	1.93E-13	---	---	---	NA	1.93E-13
Indeno(1,2,3-cd)pyrene	5.9	1.15E-17	NA	---	---	---	1.15E-17	NA
Phenanthrene	24	NA	1.43E-11	---	---	---	NA	1.43E-11
Pyrene	21	NA	5.04E-13	---	---	---	NA	5.04E-13
Carbazole	---	---	---	6.4	1.78E-12	1.78E-07	1.78E-12	1.78E-07
Organics Total Risk		**8.92E-13**	**1.51E-08**		**1.09E-10**	**2.16E-05**	**1.10E-10**	**2.17E-05**
TPH-GRO	---	---	---	388	NA	2.41E-03	NA	2.41E-03
TPH-DRO	---	---	---	1,683	NA	3.40E-01	NA	3.40E-01
TPH-ORO	---	---	---	238	NA	1.28E-01	NA	1.28E-01
TPH Total Risk		**NA**	**NA**		**NA**	**4.70E-01**	**NA**	**4.70E-01**
Arsenic	7,508	NA	NA	48	NA	NA	NA	NA
Manganese	---	---	---	4,864	NA	NA	NA	NA
Selenium	1,262	NA	NA	---	---	---	NA	NA
Metals Total Risk		**NA**	**NA**		**NA**	**NA**	**NA**	**NA**
CUMULATIVE RISK		**8.92E-13**	**1.51E-08**		**1.09E-10**	**4.70E-01**	**1.10E-10**	**4.70E-01**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
GRO: Gasoline range organic
DRO: Diesel range organic
ORO: Oil range organic
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter

Table 6-8(a)

Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker
Area 5: IWTP, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc. (ug/kg)	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc. (ug/L)	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
		IELCR	HQ		IELCR	HQ		
TPH-GRO	93,000	NA	2.83E-04	---	---	---	NA	2.83E-04
TPH-DRO	200,000	NA	6.07E-05	---	---	---	NA	6.07E-05
TPH Total Risk		**NA**	**3.44E-04**		**NA**	**NA**	**NA**	**3.44E-04**
Arsenic	8,226	NA	NA	---	---	---	NA	NA
Chromium	---	---	---	170	NA	NA	NA	NA
Cyanide, total	241	NA	NA	---	---	---	NA	NA
Mercury	65	NA	1.83E-04	---	---	---	NA	1.83E-04
Nickel	15,500	NA	NA	---	---	---	NA	NA
Selenium	1,201	NA	NA	---	---	---	NA	NA
Metals Total Risk		**NA**	**1.83E-04**		**NA**	**NA**	**NA**	**1.83E-04**
CUMULATIVE RISK		**NA**	**5.27E-04**		**NA**	**NA**	**NA**	**5.27E-04**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
DRO: Diesel range organic
GRO: Gasoline range organic
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter

Table 7A-10(a)

Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker

Sub-area 6A: GKN Facility, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc. (ug/kg)	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc. (ug/L)	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
		IELCR	HQ		IELCR	HQ		
Benzene	---	---	---	0.76	6.73E-11	1.27E-06	6.73E-11	1.27E-06
Organics Total Risk		**NA**	**NA**		**6.73E-11**	**1.27E-06**	**6.73E-11**	**1.27E-06**
TPH-GRO	---	---	---	730	NA	4.46E-03	NA	4.46E-03
TPH-DRO	---	---	---	250	NA	4.95E-02	NA	4.95E-02
TPH Total Risk		**NA**	**NA**		**NA**	**5.40E-02**	**NA**	**5.40E-02**
Arsenic	---	---	---	102	NA	NA	NA	NA
Barium	---	---	---	11,567	NA	NA	NA	NA
Cadmium	---	---	---	7.5	NA	NA	NA	NA
Chromium	---	---	---	539	NA	NA	NA	NA
Metals Total Risk		**NA**	**NA**		**NA**	**NA**	**NA**	**NA**
CUMULATIVE RISK		**NA**	**NA**		**6.73E-11**	**5.40E-02**	**6.73E-11**	**5.40E-02**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
GRO: Gasoline range organic
ug/L: Micrograms per liter
ug/kg: Micrograms per kilogram

Table 7B-10(a)

Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker

Sub-area 6B: GKN Facility, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc. (ug/kg)	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc. (ug/L)	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
		IELCR	HQ		IELCR	HQ		
1,1-Dichloroethene	---	---	---	8.0	3.64E-08	1.02E-05	3.64E-08	1.02E-05
1,1,2-Trichloro-1,2,2-trifluoroethane	---	---	---	640	NA	3.34E-05	NA	3.34E-05
1,2,3-Trimethylbenzene	---	---	---	0.7	NA	3.16E-06	NA	3.16E-06
1,2,4-Trimethylbenzene	---	---	---	3.4	NA	2.91E-05	NA	2.91E-05
Acetone	67	NA	7.52E-08	---	---	---	NA	7.52E-08
Benzene	---	---	---	13	1.31E-09	2.47E-05	1.31E-09	2.47E-05
Bromomethane	---	---	---	14	NA	1.51E-04	NA	1.51E-04
cis-1,2-Dichloroethene	1	NA	4.77.E-07	582	NA	5.97E-04	NA	5.98E-04
Dichlorodifluoromethane	---	---	---	35	NA	1.47E-04	NA	1.47E-04
Ethylbenzene	3.2	NA	1.36E-08	---	---	---	NA	1.36E-08
Methylene chloride	---	---	---	13	5.73E-11	8.51E-07	5.73E-11	8.51E-07
Methyl tert-butyl ether (MTBE)	---	---	---	32	1.80E-11	6.43E-08	1.80E-11	6.43E-08
Tetrachloroethene	8	3.61E-10	6.34E-07	20	5.93E-09	1.04E-05	6.29E-09	1.11E-05
Toluene	9	NA	1.93E-08	---	---	---	NA	1.93E-08
trans-1,2-Dichlorobenzene	36	NA	1.04E-07	---	---	---	NA	1.04E-07
trans-1,2-Dichloroethene	---	---	---	58	NA	6.17E-05	NA	6.17E-05
Trichloroethene	15	1.43E-10	5.59E-07	112	7.29E-09	2.85E-05	7.43E-09	2.91E-05
Vinyl chloride	10.3	9.35E-09	3.06E-05	149	1.33E-07	4.34E-04	1.42E-07	4.65E-04
Xylenes, total	10	NA	3.27E-07	---	---	---	NA	3.27E-07
Aroclor 1254	---	---	---	296	NA	NA	NA	NA
Acenaphthene	1,096	NA	1.62E-08	---	---	---	NA	1.62E-08
Acenaphthylene	40	NA	4.88E-10	---	---	---	NA	4.88E-10
Benzo(a)anthracene	126	6.71E-14	NA	126	1.28E-09	NA	1.28E-09	NA
Benzo(b)fluoranthene	126	3.80E-14	NA	---	---	---	3.80E-14	NA
Chrysene	173	1.70E-14	NA	---	---	---	1.70E-14	NA
Fluoranthene	185	NA	6.17E-11	---	---	---	NA	6.17E-11
Fluorene	133	NA	7.42E-10	---	---	---	NA	7.42E-10
Pyrene	171	NA	7.78E-11	---	---	---	NA	7.78E-11
Organics Total Risk		**9.85E-09**	**3.28E-05**		**1.85E-07**	**1.53E-03**	**1.95E-07**	**1.56E-03**
Aliphatics > nC6 to nC8 (TX1006)	---	---	---	8.85E+02	NA	6.06E-04	NA	6.06E-04
Aliphatics > nC8 to nC10 (TX1006)	---	---	---	5.53E+01	NA	1.11E-03	NA	1.11E-03
Aromatics > nC8 to nC10 (TX1006)	---	---	---	5.53E+01	NA	3.52E-05	NA	3.52E-05
TPH-GRO	**478**	**NA**	**4.90E-06**	**9.96E+02**	**NA**	**1.75E-03**	**NA**	**1.76E-03**

Table 7B-10(a)

Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker

Sub-area 6B: GKN Facility, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc. (ug/kg)	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc. (ug/L)	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
		IELCR	HQ		IELCR	HQ		
Aliphatics > nC10 to nC12 (TX1006)	---	---	---	3.40E+01	NA	1.03E-03	NA	1.03E-03
Aliphatics > nC12 to nC16 (TX1006)	---	---	---	7.60E-01	NA	9.94E-05	NA	9.94E-05
Aliphatics > nC16 to nC21 (TX1006)	---	---	---	2.50E-03	NA	3.08E-06	NA	3.08E-06
Aromatics > nC10 to nC12 (TX1006)	---	---	---	5.58E+03	NA	1.10E-03	NA	1.10E-03
Aromatics > nC12 to nC16 (TX1006)	---	---	---	5.58E+03	NA	4.43E-04	NA	4.43E-04
Aromatics > nC16 to nC21 (TX1006)	---			6.50E+02	NA	1.39E-05	NA	1.39E-05
TPH-DRO	**47,583**	**NA**	**4.82E-05**	**1.18E+04**	**NA**	**2.69E-03**	**NA**	**2.74E-03**
Aliphatics > nC21 to nC35 (TX1006)	---	---	---	2.50E-03	NA	3.08E-06	NA	3.08E-06
Aromatics > nC21 to nC35 (TX1006)	---	---	---	6.60E+00	NA	1.61E-08	NA	1.61E-08
TPH-ORO	**---**	**---**	**---**	**6.60E+00**	**NA**	**3.10E-06**	**NA**	**3.10E-06**
TPH Total Risk		**NA**	**5.31E-05**		**NA**	**4.45E-03**	**NA**	**4.50E-03**
Arsenic	27,807	NA	NA	108	NA	NA	NA	NA
Barium	---	---	---	5,440	NA	NA	NA	NA
Cadmium	583	NA	NA	1,177	NA	NA	NA	NA
Chromium	---	---	---	412	NA	NA	NA	NA
Mercury	34	NA	9.69E-05	1.2	NA	1.53E-04	NA	2.50E-04
Selenium	1,687	NA	NA	---	---	---	NA	NA
Antimony	3,964	NA	NA	---	---	---	NA	NA
Beryllium	937	NA	NA	---	---	---	NA	NA
Cobalt	8,404	NA	NA	---	---	---	NA	NA
Copper	19,350	NA	NA	---	---	---	NA	NA
Manganese	1,084,100	NA	NA	6,400	NA	NA	NA	NA
Nickel	28,150	NA	NA	---	---	---	NA	NA
Zinc	52,140	NA	NA	---	---	---	NA	NA
Metals Total Risk		**NA**	**9.69E-05**		**NA**	**1.53E-04**	**NA**	**2.50E-04**
CUMULATIVE RISK		**9.85E-09**	**1.83E-04**		**1.85E-07**	**6.13E-03**	**1.95E-07**	**6.31E-03**

Notes:

NA: Not available

---: Risk evaluation was not performed.

HI: Hazard index

TPH: Total petroleum hydrocarbon

GRO: Gasoline range organic

DRO: Diesel range organic

ORO: Oil range organic

ug/L: Micrograms per liter

ug/kg: Micrograms per kilogram

Table 7C-10(a)

Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker

Sub-area 6C: GKN Facility, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc. (ug/kg)	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc. (ug/L)	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
		IELCR	HQ		IELCR	HQ		
2-Hexanone (MBK)	---	---	---	4.3	NA	9.83E-07	NA	9.83E-07
Acetone	55	NA	1.90E-08	---	---	---	NA	1.90E-08
cis-1,2-Dichloroethene	2.5	NA	4.48E-07	96	NA	1.05E-04	NA	1.05E-04
Dichlorodifluoromethane	3.6	NA	1.67E-06	---	---	---	NA	1.67E-06
Ethylbenzene	540	NA	7.08E-07	---	---	---	NA	7.08E-07
Methyl ethyl ketone (MEK)	13	NA	1.76E-09	---	---	---	NA	1.76E-09
Methyl isobutyl ketone	11	NA	2.74E-10	---	---	---	NA	2.74E-10
o-Xylene	600	NA	3.25E-08	---	---	---	NA	3.25E-08
Trichloroethene	4.2	1.21E-11	4.75E-08	240	1.77E-08	6.94E-05	1.77E-08	6.94E-05
Vinyl chloride	---	---	---	5.2	5.55E-09	1.82E-05	5.55E-09	1.82E-05
Xylenes, total	206	NA	2.10E-06	---	---	---	NA	2.10E-06
Chrysene	406	1.23E-14	NA	---	---	---	1.23E-14	NA
Organics Total Risk		**1.21E-11**	**5.02E-06**		**2.33E-08**	**1.93E-04**	**2.33E-08**	**1.98E-04**
Aliphatics > nC6 to nC8 (TX1006)	---	---	---	1.10E+02	NA	9.05E-05	NA	9.05E-05
Aliphatics > nC8 to nC10 (TX1006)	---	---	---	4.65E+01	NA	1.13E-03	NA	1.13E-03
Aromatics > nC8 to nC10 (TX1006)	---	---	---	4.65E+01	NA	3.40E-05	NA	3.40E-05
TPH-GRO	**64,052**	**NA**	**2.02E-04**	**2.03E+02**	**NA**	**1.25E-03**	**NA**	**1.45E-03**
Aliphatics > nC10 to nC12 (TX1006)	---	---	---	3.40E+01	NA	1.23E-03	NA	1.23E-03
Aliphatics > nC12 to nC16 (TX1006)	---	---	---	7.60E-01	NA	1.20E-04	NA	1.20E-04
Aliphatics > nC16 to nC21 (TX1006)	---	---	---	2.50E-03	NA	3.71E-06	NA	3.71E-06
Aromatics > nC10 to nC12 (TX1006)	---	---	---	1.50E+03	NA	3.20E-04	NA	3.20E-04
Aromatics > nC12 to nC16 (TX1006)	---	---	---	1.95E+03	NA	1.59E-04	NA	1.59E-04
Aromatics > nC16 to nC21 (TX1006)	---	---	---	6.50E+02	NA	1.37E-05	NA	1.37E-05
TPH-DRO	**566,000**	**NA**	**1.77E-04**	**4.13E+03**	**NA**	**1.85E-03**	**NA**	**2.03E-03**

Table 7C-10(a)

Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker

Sub-area 6C: GKN Facility, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc. (ug/kg)	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc. (ug/L)	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
		IELCR	HQ		IELCR	HQ		
Aliphatics > nC21 to nC35 (TX1006)	---	---	---	2.50E-03	NA	3.71E-06	NA	3.71E-06
Aromatics > nC21 to nC35 (TX1006)	---	---	---	6.60E+00	NA	1.56E-08	NA	1.56E-08
TPH-ORO	---	---	---	**6.60E+00**	**NA**	**3.72E-06**	**NA**	**3.72E-06**
TPH Total Risk		**NA**	**3.79E-04**		**NA**	**3.10E-03**	**NA**	**3.48E-03**
Arsenic	6,061	NA	NA	81	NA	NA	NA	NA
Barium	---	---	---	2,574	NA	NA	NA	NA
Cadmium	---	---	---	669	NA	NA	NA	NA
Chromium	27,165	NA	NA	2,381	NA	NA	NA	NA
Chromium, hexavalent	---	---	---	16	NA	NA	NA	NA
Mercury	33	NA	2.86E-05	0.76	NA	1.11E-04	NA	1.39E-04
Selenium	342	NA	NA	---	---	---	NA	NA
Metals Total Risk		**NA**	**2.86E-05**		**NA**	**1.11E-04**	**NA**	**1.39E-04**
CUMULATIVE RISK		**1.21E-11**	**4.13E-04**		**2.33E-08**	**3.41E-03**	**2.33E-08**	**3.82E-03**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
GRO: Gasoline range organic
DRO: Diesel range organic
ORO: Oil range organic
ug/L: Micrograms per liter
ug/kg: Micrograms per kilogram

Table 7D-10(a)

Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker

Sub-area 6D: GKN Facility, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc. (ug/L)	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ		IELCR	HQ		
Dichlorodifluoromethane	5.5	NA	8.16E-06	---	---	---	NA	8.16E-06
Tetrachloroethene	---	---	---	12	3.08E-09	5.41E-06	3.08E-09	5.41E-06
Toluene	39	NA	7.99E-08	---	---	---	NA	7.99E-08
Organics Total Risk		**NA**	**8.24E-06**		**3.08E-09**	**5.41E-06**	**3.08E-09**	**1.36E-05**
TPH-GRO	12,000	NA	1.23E-04	---	---	---	NA	1.23E-04
TPH-DRO	2,500	NA	2.52E-06	---	---	---	NA	2.52E-06
TPH-ORO	2,500	NA	6.38E-08	---	---	---	NA	6.38E-08
TPH Total Risk		**NA**	**1.25E-04**		**NA**	**NA**	**NA**	**1.25E-04**
Arsenic	---	---	---	8.9	NA	NA	NA	NA
Chromium	---	---	---	41	NA	NA	NA	NA
Metals Total Risk		**NA**	**NA**		**NA**	**NA**	**NA**	**NA**
CUMULATIVE RISK		**NA**	**1.33E-04**		**3.08E-09**	**5.41E-06**	**3.08E-09**	**1.39E-04**

Notes:

NA: Not available

---: Risk evaluation was not performed.

HI: Hazard index

TPH: Total petroleum hydrocarbon

GRO: Gasoline range organic

DRO: Diesel range organic

ORO: Oil range organic

ug/L: Micrograms per liter

ug/kg: Micrograms per kilogram

Table 9A-11(a)

Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker

Sub-area 8A: Office Complex North, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc. (ug/L)	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ		IELCR	HQ		
Toluene	---	---	---	1.5	NA	2.37E-08	NA	2.37E-08
Trichloroethene	40	3.74E-10	1.46E-06	110	7.28E-09	2.85E-05	7.65E-09	3.00E-05
Vinyl chloride	---	---	---	1.9	1.73E-09	5.67E-06	1.73E-09	5.67E-06
Organics Total Risk		**3.74E-10**	**1.46E-06**		**9.01E-09**	**3.42E-05**	**9.39E-09**	**3.57E-05**
Arsenic	12,500	NA	NA	23	NA	NA	NA	NA
Barium	---	---	---	860	NA	NA	NA	NA
Chromium	---	---	---	110	NA	NA	NA	NA
Manganese	---	---	---	1,300	NA	NA	NA	NA
Mercury	38	NA	1.09E-04	---	---	---	NA	1.09E-04
Metals Total Risk		**NA**	**NA**		**NA**	**NA**	**NA**	**NA**
CUMULATIVE RISK		**3.74E-10**	**1.46E-06**		**9.01E-09**	**3.42E-05**	**9.39E-09**	**3.57E-05**

Notes:

NA: Not available

---: Risk evaluation was not performed.

HI: Hazard index

ug/kg: Micrograms per kilogram

ug/L: Micrograms per liter

Table 9B-11(a)

Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker

Sub-area 8B: Office Complex North, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc. (ug/kg)	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc. (ug/L)	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
		IELCR	HQ		IELCR	HQ		
Aliphatics > nC6 to nC8 (TX1006)	---	---	---	8.33E+01	NA	4.87E-05	NA	4.87E-05
Aliphatics > nC8 to nC10 (TX1006)	---	---	---	8.33E+01	NA	1.43E-03	NA	1.43E-03
Aromatics > nC8 to nC10 (TX1006)	---	---	---	8.33E+01	NA	4.67E-05	NA	4.67E-05
TPH-GRO	---	---	---	**2.50E+02**	**NA**	**1.53E-03**	**NA**	**1.53E-03**
Aliphatics > nC10 to nC12 (TX1006)	---	---	---	3.40E+01	NA	8.77E-04	NA	8.77E-04
Aliphatics > nC12 to nC16 (TX1006)	---	---	---	7.60E-01	NA	8.49E-05	NA	8.49E-05
Aliphatics > nC16 to nC21 (TX1006)	---	---	---	2.50E-03	NA	2.63E-06	NA	2.63E-06
Aromatics > nC10 to nC12 (TX1006)	---	---	---	4.67E+02	NA	8.46E-05	NA	8.46E-05
Aromatics > nC12 to nC16 (TX1006)	---	---	---	3.74E+03	NA	2.82E-04	NA	2.82E-04
Aromatics > nC16 to nC21 (TX1006)	---	---	---	6.50E+02	NA	1.37E-05	NA	1.37E-05
TPH-DRO	---	---	---	**4.89E+03**	**NA**	**1.34E-03**	**NA**	**1.34E-03**
Aliphatics > nC21 to nC35 (TX1006)	---	---	---	2.50E-03	NA	2.63E-06	NA	2.63E-06
Aromatics > nC21 to nC35 (TX1006)	---	---	---	6.60E+00	NA	1.61E-08	NA	1.61E-08
TPH-ORO	---	---	---	**6.60E+00**	**NA**	**2.65E-06**	**NA**	**2.65E-06**
TPH Total Risk		**NA**	**NA**		**NA**	**2.88E-03**	**NA**	**2.88E-03**
Arsenic	---	---	---	15	NA	NA	NA	NA
Chromium	---	---	---	51	NA	NA	NA	NA
Metals Total Risk		**NA**	**NA**		**NA**	**NA**	**NA**	**NA**
CUMULATIVE RISK		**NA**	**NA**		**NA**	**2.88E-03**	**NA**	**2.88E-03**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
DRO: Diesel range organic
GRO: Gasoline range organic
ORO: Oil range organic
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter

Table 9C-11(a)

Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker

Sub-area 8C: Office Complex North, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc. (ug/kg)	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc. (ug/L)	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
		IELCR	HQ		IELCR	HQ		
TPH-GRO	---	---	---	650	NA	4.72E-03	NA	4.72E-03
TPH-DRO	---	---	---	250	NA	5.90E-02	NA	5.90E-02
TPH Total Risk		**NA**	**NA**		**NA**	**6.38E-02**	**NA**	**6.38E-02**
CUMULATIVE RISK		**NA**	**NA**		**NA**	**6.38E-02**	**NA**	**6.38E-02**

Notes:

NA: Not available

---: Risk evaluation was not performed.

HI: Hazard index

TPH: Total petroleum hydrocarbon

DRO: Diesel range organic

GRO: Gasoline range organic

ug/kg: Micrograms per kilogram

ug/L: Micrograms per liter

Table 10-8(a)

Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Current On-site Non-residential Worker

Area 9: Gun Range, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc. (ug/kg)	Indoor Inhalation of Vapors from Subsurface Soil		Average GW Conc. (ug/L)	Indoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
		IELCR	HQ		IELCR	HQ		
Acetone	20	NA	2.24E-08	---	---	---	NA	2.24E-08
Methylene chloride	2.9	1.79E-11	2.65E-07	---	---	---	1.79E-11	2.65E-07
Naphthalene	2.6	NA	3.46E-11	---	---	---	NA	3.46E-11
Organics Total Risk		**1.79E-11**	**2.88E-07**		**NA**	**NA**	**1.79E-11**	**2.88E-07**
TPH-GRO	---	---	---	500	NA	3.04E-03	NA	3.04E-03
TPH-DRO	---	---	---	121	NA	2.39E-02	NA	2.39E-02
TPH-ORO	---	---	---	311	NA	1.63E-01	NA	1.63E-01
TPH Total Risk		**NA**	**NA**		**NA**	**1.90E-01**	**NA**	**1.90E-01**
Arsenic	---	---	---	37	NA	NA	NA	NA
Cadmium	513	NA	NA	---	---	---	NA	NA
Copper	17,700	NA	NA	---	---	---	NA	NA
Manganese	1,178,000	NA	NA	1,750	NA	NA	NA	NA
Nickel	20,100	NA	NA	---	---	---	NA	NA
Selenium	1,363	NA	NA	---	---	---	NA	NA
Zinc	63,700	NA	NA	---	---	---	NA	NA
Metals Total Risk		**NA**	**NA**		**NA**	**NA**	**NA**	**NA**
CUMULATIVE RISK		**1.79E-11**	**2.88E-07**		**NA**	**1.90E-01**	**1.79E-11**	**1.90E-01**

Notes:

NA: Not available

---: Risk evaluation was not performed.

HI: Hazard index

ug/kg: Micrograms per kilogram

ug/L: Micrograms per liter

GRO: Gasoline range organic

DRO: Diesel range organic

ORO: Oil range organic

TPH: Total petroleum organic

Table 2-9(R)

Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Future Construction Worker

Area 1: Runway Protection Zone, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc. (ug/L)	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ		IELCR	HQ	IELCR	HQ		
1,2,3-Trimethylbenzene	---	---	---	---	---	---	---	1.7	NA	NA	NA	2.40E-06	NA	2.40E-06
1,2,4-Trimethylbenzene	---	---	---	---	---	---	---	1.2	NA	NA	NA	2.52E-06	NA	2.52E-06
Acetone	25	NA	2.62E-08	NA	9.11E-09	NA	1.49E-07	48.9	NA	NA	NA	7.15E-08	NA	2.55E-07
Benzene	32,196	1.67E-08	8.98E-03	5.58E-09	2.99E-03	1.05E-07	4.96E-02	6.1	2.96E-09	1.59E-03	6.35E-12	3.00E-06	1.30E-07	6.32E-02
Ethylbenzene	32,056	NA	3.35E-04	NA	1.03E-04	NA	6.62E-04	---	---	---	---	---	NA	1.10E-03
n-Propylbenzene	---	---	---	---	---	---	---	4.3	NA	NA	NA	5.71E-07	NA	5.71E-07
Toluene	195,660	NA	2.56E-04	NA	8.53E-04	NA	1.42E-03	---	---	---	---	---	NA	2.53E-03
Xylenes, Total	130,160	NA	6.81E-04	NA	2.30E-04	NA	2.37E-02	---	---	---	---	---	NA	2.46E-02
Organics Total Risk		**1.67E-08**	**1.03E-02**	**5.58E-09**	**4.18E-03**	**1.05E-07**	**7.54E-02**		**2.96E-09**	**1.59E-03**	**6.35E-12**	**8.57E-06**	**1.30E-07**	**9.14E-02**
TPH-GRO	57,836	NA	2.87E-04	NA	2.37E-04	NA	2.26E-03	3,416	NA	NA	NA	4.14E-03	NA	6.92E-03
TPH-DRO	2,500	NA	1.87E-05	NA	1.51E-05	NA	3.18E-05	353	NA	NA	NA	1.38E-02	NA	1.39E-02
TPH-ORO	16,875	NA	2.55E-04	NA	1.96E-04	NA	8.29E-06	1,020	NA	NA	NA	1.93E-05	NA	4.79E-04
TPH Total Risk		**NA**	**5.61E-04**	**NA**	**4.48E-04**	**NA**	**2.30E-03**		**NA**	**NA**	**NA**	**1.80E-02**	**NA**	**2.13E-02**
Antimony	4,005	NA	3.49E-05	NA	3.49E-04	NA	1.34E-05	---	---	---	---	---	NA	3.97E-04
Arsenic	19,018	4.26E-08	6.63E-03	1.49E-07	2.31E-02	1.94E-10	3.02E-06	47.5	NA	NA	NA	NA	1.91E-07	2.97E-02
Beryllium	1,155	4.95E-09	2.01E-05	4.95E-08	2.01E-04	6.60E-12	9.63E-06	---	---	---	---	---	5.44E-08	2.31E-04
Cobalt	9,885	NA	1.72E-03	NA	1.72E-04	6.59E-11	8.26E-05	---	---	---	---	---	6.59E-11	1.98E-03
Copper	14,600	NA	1.27E-05	NA	1.27E-04	NA	2.43E-06	---	---	---	---	---	NA	1.42E-04
Manganese	1,338,750	NA	3.00E-04	NA	3.33E-03	NA	4.55E-03	---	---	---	---	---	NA	8.18E-03
Mercury	121	NA	1.41E-05	NA	1.41E-04	NA	1.33E-03	---	---	---	---	---	NA	1.49E-03
Nickel	23,075	NA	2.01E-06	NA	4.02E-05	1.32E-11	1.92E-05	---	---	---	---	---	1.32E-11	6.15E-05
Selenium	1,518	NA	1.06E-05	NA	8.47E-05	NA	2.53E-05	---	---	---	---	---	NA	1.21E-04
Metals Total Risk		**4.76E-08**	**8.75E-03**	**1.98E-07**	**2.76E-02**	**2.80E-10**	**6.04E-03**		**NA**	**NA**	**NA**	**NA**	**2.46E-07**	**4.23E-02**
CUMULATIVE RISK		**6.43E-08**	**1.96E-02**	**2.04E-07**	**3.22E-02**	**1.05E-07**	**8.38E-02**		**2.96E-09**	**1.59E-03**	**6.35E-12**	**1.80E-02**	**3.76E-07**	**1.55E-01**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total Petroleum Carbon
GRO: Gasoline Range Organic
DRO: Diesel Range Organic
ORO: Oil Range Organic
ug/kg: microgram per kilogram
ug/L: microgram per liter

Table 3A-12(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Future Construction Worker
Sub-area 2A: Demolished Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc.	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ	(ug/L)	IELCR	HQ	IELCR	HQ		
Benzene	622	3.24E-10	1.74E-04	1.08E-10	5.79E-05	2.20E-09	1.04E-03	220	1.07E-07	5.74E-02	7.50E-11	3.55E-05	1.10E-07	5.87E-02
Dichlorodifluoromethane	3.1	NA	5.41E-08	NA	5.41E-09	NA	2.95E-06	---	---	---	---	---	NA	3.01E-06
Ethylbenzene	570	NA	5.97E-06	NA	1.83E-06	NA	1.28E-05	---	---	---	---	---	NA	2.06E-05
Methylene chloride	3.5	3.96E-13	6.16E-08	1.32E-13	2.05E-08	1.59E-12	5.89E-07	---	---	---	---	---	2.11E-12	6.71E-07
Tetrachloroethene	10	8.47E-12	1.10E-07	2.82E-11	3.65E-07	4.61E-11	2.03E-06	---	---	---	---	---	8.28E-11	2.50E-06
Toluene	67	NA	8.83E-08	NA	2.94E-07	NA	5.34E-07	---	---	---	---	---	NA	9.16E-07
Trichloroethene	1.9	6.14E-16	2.17E-11	1.23E-13	4.34E-09	2.14E-12	2.09E-07	---	---	---	---	---	2.26E-12	2.13E-07
Xylenes, total	30.0	NA	1.57E-07	NA	5.29E-08	NA	5.93E-06	---	---	---	---	---	NA	6.14E-06
Organics Total Risk		**3.32E-10**	**1.80E-04**	**1.36E-10**	**6.04E-05**	**2.25E-09**	**1.07E-03**		**1.07E-07**	**5.74E-02**	**7.50E-11**	**3.55E-05**	**1.10E-07**	**5.87E-02**
TPH-GRO	12,428	NA	NA	NA	5.09E-05	NA	5.27E-04	70,830	NA	NA	NA	3.50E-03	NA	4.07E-03
TPH-DRO	2,228,359	NA	1.47E-02	NA	1.34E-02	NA	3.08E-02	22,344	NA	NA	NA	4.66E-04	NA	5.95E-02
TPH-ORO	2,500	NA	1.91E-05	NA	1.47E-05	NA	3.72E-06	6.6	NA	NA	NA	2.32E-07	NA	3.78E-05
TPH Total Risk		**NA**	**1.48E-02**	**NA**	**1.35E-02**	**NA**	**3.13E-02**		**NA**	**NA**	**NA**	**3.96E-03**	**NA**	**6.36E-02**
Arsenic	38,875	8.72E-08	1.36E-02	3.04E-07	4.72E-02	3.67E-09	5.71E-05	47	NA	NA	NA	NA	3.94E-07	6.08E-02
Cadmium	730	NA	2.55E-06	NA	2.55E-04	2.90E-11	6.44E-07	8.9	NA	NA	NA	NA	2.90E-11	2.58E-04
Mercury	49	NA	5.64E-06	NA	5.67E-05	NA	1.63E-03	---	---	---	---	---	NA	1.69E-03
Antimony	3,785	NA	3.30E-04	NA	3.30E-03	NA	1.17E-04	---	---	---	---	---	NA	3.75E-03
Beryllium	1,106	4.74E-09	1.93E-05	4.74E-08	1.93E-04	5.85E-11	8.54E-05	---	---	---	---	---	5.22E-08	2.97E-04
Cobalt	6,125	NA	1.07E-03	NA	1.07E-04	3.78E-10	4.74E-04	---	---	---	---	---	3.78E-10	1.65E-03
Copper	33,525	NA	2.92E-05	NA	2.92E-04	NA	5.17E-05	---	---	---	---	---	NA	3.73E-04
Nickel	15,750	NA	1.37E-06	NA	2.75E-05	8.33E-11	1.22E-04	---	---	---	---	---	8.33E-11	1.50E-04
Zinc	86,675	NA	1.01E-05	NA	1.01E-04	NA	1.27E-07	---	---	---	---	---	NA	1.11E-04
Metals Total Risk		**9.19E-08**	**1.50E-02**	**3.51E-07**	**5.16E-02**	**4.22E-09**	**2.54E-03**		**NA**	**NA**	**NA**	**NA**	**4.47E-07**	**6.91E-02**
CUMULATIVE RISK		**9.22E-08**	**3.00E-02**	**3.51E-07**	**6.51E-02**	**6.48E-09**	**3.49E-02**		**1.07E-07**	**5.74E-02**	**7.50E-11**	**4.00E-03**	**5.57E-07**	**1.91E-01**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter
GRO: Gasoline range organic
DRO: Diesel range organic
ORO: Oil range organic
TPH: Total petroleum hydrocarbon

Table 3B-12(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Future Construction Worker
Sub-area 2B: Demolished Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc.	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ	(ug/L)	IELCR	HQ	IELCR	HQ		
1,1-Dichloroethene	60	5.38E-10	1.39E-06	1.79E-10	4.65E-07	4.67E-09	3.28E-05	150	4.78E-07	1.24E-03	1.68E-09	1.18E-05	4.85E-07	1.29E-03
1,2,3-Trimethylbenzene	---	---	---	---	---	---	---	48	NA	NA	NA	2.24E-05	NA	2.24E-05
1,2,4-Trimethylbenzene	78	NA	1.63E-06	NA	5.00E-07	NA	8.31E-05	182	NA	NA	NA	1.25E-04	NA	2.10E-04
Acetone	1,966	NA	2.06E-06	NA	7.16E-07	NA	1.23E-05	---	---	---	---	---	NA	1.50E-05
Benzene	---	---	---	---	---	---	---	239	1.16E-07	6.23E-02	8.15E-11	3.86E-05	1.16E-07	6.24E-02
Chloroethane	28	4.05E-12	2.44E-07	4.05E-13	2.44E-08	4.37E-11	3.64E-07	---	---	---	---	---	4.82E-11	6.33E-07
cis-1,2-Dichloroethene	3,128	NA	3.27E-05	NA	1.09E-04	NA	4.42E-03	4,497	NA	NA	NA	5.15E-04	NA	5.08E-03
Ethylbenzene	109	NA	1.14E-06	NA	3.85E-07	NA	2.45E-06	---	---	---	---	---	NA	3.97E-06
Isopropyl benzene	561	NA	5.87E-06	NA	1.96E-06	NA	9.79E-05	---	---	---	---	---	NA	1.06E-04
m,p-Xylene	199	NA	3.47E-07	NA	3.47E-08	NA	1.35E-05	---	---	---	---	---	NA	1.39E-05
Methyl ethyl ketone (MEK)	1,131	NA	1.97E-06	NA	6.57E-07	NA	3.67E-06	---	---	---	---	---	NA	6.30E-06
Methylene chloride	275	3.08E-11	4.80E-06	1.03E-11	1.60E-06	1.23E-10	4.58E-05	---	---	---	---	---	1.64E-10	5.22E-05
Methyl tert-butyl ether	---	---	---	---	---	---	---	222	1.10E-09	5.41E-05	1.92E-12	1.72E-07	1.10E-09	5.43E-05
Naphthalene	5,349	NA	1.12E-04	NA	1.12E-04	NA	3.92E-03	321	NA	NA	NA	1.82E-04	NA	4.32E-03
n-Butylbenzene	1,089	NA	9.49E-05	NA	9.49E-06	NA	8.30E-05	221	NA	NA	NA	1.14E-05	NA	1.99E-04
n-Propylbenzene	884	NA	2.77E-05	NA	9.25E-06	NA	1.17E-04	189	NA	NA	NA	8.19E-06	NA	1.62E-04
o-Xylene	70	NA	1.22E-07	NA	1.22E-08	NA	4.93E-07	---	---	---	---	---	NA	6.27E-07
p-Isopropyltoluene	266	NA	2.78E-06	NA	2.78E-07	NA	2.55E-06	---	---	---	---	---	NA	5.61E-06
sec-Butylbenzene	1,044	NA	9.10E-05	NA	9.10E-06	NA	1.07E-04	207	NA	NA	NA	1.42E-05	NA	2.21E-04
Tetrachloroethene	200,066	1.62E-07	2.09E-03	5.39E-07	6.98E-03	8.80E-07	3.87E-02	19,115	3.30E-04	4.27E+00	1.50E-08	6.58E-04	3.31E-04	4.31E+00
Toluene	352	NA	4.60E-07	NA	1.53E-06	NA	2.78E-06	649	NA	1.70E-02	NA	8.18E-07	NA	1.70E-02
trans-1,2-Dichloroethene	420	NA	2.20E-06	NA	7.32E-06	NA	3.65E-04	150	NA	NA	NA	1.33E-05	NA	3.87E-04
Trichloroethene	498	1.64E-13	5.79E-09	3.27E-11	1.16E-06	5.70E-10	5.58E-05	1,991	2.79E-07	9.87E-03	3.76E-10	3.68E-05	2.80E-07	9.97E-03
Vinyl chloride	138	1.57E-12	4.81E-08	5.22E-10	1.60E-05	3.16E-09	2.59E-04	728	2.68E-06	8.23E-02	1.44E-09	1.18E-04	2.69E-06	8.27E-02
Xylenes, Total	518	NA	9.03E-08	NA	2.48E-07	NA	1.02E-04	---	---	---	---	---	NA	1.03E-04
Organics Total Risk		**1.62E-07**	**2.48E-03**	**5.40E-07**	**7.26E-03**	**8.89E-07**	**4.84E-02**		**3.33E-04**	**4.44E+00**	**1.85E-08**	**1.75E-03**	**3.35E-04**	**4.50E+00**
Aliphatics > nC6 to nC8 (TX1006)	---	---	---	---	---	---	---	4.66E+03	NA	NA	NA	1.75E-04	NA	1.75E-04
Aliphatics > nC8 to nC10 (TX1006)	---	---	---	---	---	---	---	4.30E+02	NA	NA	NA	4.74E-04	NA	4.74E-04
Aromatics > nC8 to nC10 (TX1006)	---	---	---	---	---	---	---	2.73E+03	NA	NA	NA	1.19E-04	NA	1.19E-04
TPH-GRO	**37,150**	**NA**	**NA**	**NA**	**1.69E-04**	**NA**	**2.19E-04**	**7.82E+03**	**NA**	**NA**	**NA**	**7.68E-04**	**NA**	**1.16E-03**
Aliphatics > nC10 to nC12 (TX1006)	---	---	---	---	---	---	---	3.40E+01	NA	NA	NA	5.62E-05	NA	5.62E-05
Aliphatics > nC12 to nC16 (TX1006)	---	---	---	---	---	---	---	7.60E-01	NA	NA	NA	5.44E-06	NA	5.44E-06
Aliphatics > nC16 to nC21 (TX1006)	---	---	---	---	---	---	---	2.50E-03	NA	NA	NA	1.69E-07	NA	1.69E-07
Aromatics > nC10 to nC12 (TX1006)	---	---	---	---	---	---	---	8.11E+03	NA	NA	NA	1.62E-04	NA	1.62E-04
Aromatics > nC12 to nC16 (TX1006)	---	---	---	---	---	---	---	5.80E+03	NA	NA	NA	8.13E-05	NA	8.13E-05
Aromatics > nC16 to nC21 (TX1006)	---	---	---	---	---	---	---	6.50E+02	NA	NA	NA	7.27E-06	NA	7.27E-06
TPH-DRO	**521,665**	**NA**	**1.15E-03**	**NA**	**3.50E-03**	**NA**	**1.00E-03**	**1.46E+04**	**NA**	**NA**	**NA**	**3.13E-04**	**NA**	**5.96E-03**
Aliphatics > nC21 to nC35 (TX1006)	---	---	---	---	---	---	---	2.50E-03	NA	NA	NA	1.69E-07	NA	1.69E-07
Aromatics > nC21 to nC35 (TX1006)	---	---	---	---	---	---	---	6.60E+00	NA	NA	NA	6.40E-08	NA	6.40E-08
TPH-ORO	**30,667**	**NA**	**7.81E-05**	**NA**	**2.01E-04**	**NA**	**6.33E-06**	**6.60E+00**	**NA**	**NA**	**NA**	**2.32E-07**	**NA**	**2.86E-04**
TPH Total Risk		**NA**	**1.23E-03**	**NA**	**3.87E-03**	**NA**	**1.23E-03**		**NA**	**NA**	**NA**	**1.08E-03**	**NA**	**7.40E-03**

Table 3B-12(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Future Construction Worker
Sub-area 2B: Demolished Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc.	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ	(ug/L)	IELCR	HQ	IELCR	HQ		
Arsenic	10,969	2.46E-08	3.83E-03	8.57E-08	1.33E-02	1.04E-09	1.61E-05	67	NA	NA	NA	NA	1.11E-07	1.72E-02
Cadmium	1,289	NA	4.50E-06	NA	4.50E-04	5.12E-11	1.14E-06	4.0	NA	NA	NA	NA	5.12E-11	4.55E-04
Chromium	22,860	NA	NA	NA	NA	6.05E-09	NA	---	---	---	---	---	6.05E-09	NA
Mercury	194	NA	2.26E-05	NA	2.27E-04	NA	6.54E-03	---	---	---	---	---	NA	6.79E-03
Selenium	909	NA	6.34E-06	NA	6.34E-05	NA	7.03E-06	---	---	---	---	---	NA	7.68E-05
Silver	1,122	NA	7.04E-06	NA	7.83E-05	NA	1.73E-04	---	---	---	---	---	NA	2.58E-04
Antimony	2,513	NA	2.19E-04	NA	2.19E-03	NA	7.78E-05	---	---	---	---	---	NA	2.49E-03
Beryllium	849	3.64E-09	1.48E-05	3.64E-08	1.48E-04	4.49E-11	6.56E-05	---	---	---	---	---	4.00E-08	2.28E-04
Cobalt	6,613	NA	1.15E-03	NA	1.15E-04	4.08E-10	5.12E-04	---	---	---	---	---	4.08E-10	1.78E-03
Copper	11,748	NA	1.02E-05	NA	1.02E-04	NA	1.81E-05	---	---	---	---	---	NA	1.31E-04
Manganese	844,250	NA	1.89E-04	NA	2.10E-03	NA	2.66E-02	---	---	---	---	---	NA	2.89E-02
Nickel	17,715	NA	1.54E-06	NA	3.09E-05	9.37E-11	1.37E-04	---	---	---	---	---	9.37E-11	1.69E-04
Thallium	2,039	NA	8.89E-04	NA	8.89E-03	NA	1.12E-05	---	---	---	---	---	NA	9.79E-03
Zinc	36,425	NA	4.23E-06	NA	4.23E-05	NA	5.35E-08	---	---	---	---	---	NA	4.66E-05
Metals Total Risk		**2.82E-08**	**6.35E-03**	**1.22E-07**	**2.78E-02**	**7.68E-09**	**3.42E-02**		**NA**	**NA**	**NA**	**NA**	**1.58E-07**	**6.83E-02**
CUMULATIVE RISK		**1.91E-07**	**1.01E-02**	**6.62E-07**	**3.89E-02**	**8.96E-07**	**8.38E-02**		**3.33E-04**	**4.44E+00**	**1.85E-08**	**2.84E-03**	**3.35E-04**	**4.57E+00**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter
GRO: Gasoline range organic
DRO: Diesel range organic
ORO: Oil range organic
TPH: Total petroleum hydrocarbon

Table 3C-12(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Future Construction Worker
Sub-area 2C: Demolished Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc.	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ	(ug/L)	IELCR	HQ	IELCR	HQ		
Benzene	102	5.33E-11	2.86E-05	1.78E-11	9.52E-06	3.63E-10	1.72E-04	203	9.84E-08	5.28E-02	2.09E-11	9.88E-06	9.89E-08	5.30E-02
Ethylbenzene	172	NA	1.80E-06	NA	6.08E-07	NA	3.87E-06	---	---	---	---	---	NA	6.28E-06
Methylene chloride	5.8	6.50E-13	1.01E-07	2.17E-13	3.37E-08	2.60E-12	9.66E-07	---	---	---	---	---	3.47E-12	1.10E-06
Toluene	762	NA	9.97E-07	NA	3.32E-06	NA	6.03E-06	---	---	---	---	---	NA	1.04E-05
Xylenes, Total	415	NA	7.23E-08	NA	1.99E-07	NA	8.20E-05	---	---	---	---	---	NA	8.23E-05
Organics Total Risk		**5.39E-11**	**3.15E-05**	**1.80E-11**	**1.37E-05**	**3.65E-10**	**2.65E-04**		**9.84E-08**	**5.28E-02**	**2.09E-11**	**9.88E-06**	**9.89E-08**	**5.31E-02**
TPH-GRO	97,167	NA	NA	NA	3.98E-04	NA	4.12E-03	73,658	NA	NA	NA	5.09E-02	NA	5.55E-02
TPH-DRO	177,313	NA	1.17E-03	NA	1.07E-03	NA	2.45E-03	513	NA	NA	NA	1.14E-02	NA	1.61E-02
TPH-ORO	15,167	NA	1.16E-04	NA	8.95E-05	NA	2.25E-05	429	NA	NA	NA	2.54E-02	NA	2.56E-02
TPH Total Risk		**NA**	**1.29E-03**	**NA**	**1.56E-03**	**NA**	**6.59E-03**		**NA**	**NA**	**NA**	**8.77E-02**	**NA**	**9.72E-02**
CUMULATIVE RISK		**5.39E-11**	**1.32E-03**	**1.80E-11**	**1.57E-03**	**3.65E-10**	**6.86E-03**		**9.84E-08**	**5.28E-02**	**2.09E-11**	**8.77E-02**	**9.89E-08**	**1.50E-01**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter
GRO: Gasoline range organic
DRO: Diesel range organic
ORO: Oil range organic
TPH: Total petroleum hydrocarbon

Table 4A-10(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Future Construction Worker
Sub-area 3A: Retained Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc. (ug/L)	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ		IELCR	HQ	IELCR	HQ		
1,2,4-Trimethylbenzene	13	NA	2.67E-07	NA	8.89E-08	NA	1.36E-05	7.8	NA	NA	NA	1.18E-05	NA	2.58E-05
1,3,5-Trimethylbenzene	26	NA	5.35E-07	NA	1.78E-07	NA	6.86E-05	---	---	---	---	---	NA	6.93E-05
Benzene	32	1.66E-11	8.91E-06	5.54E-12	2.97E-06	1.13E-10	5.35E-05	69	3.35E-08	1.80E-02	5.23E-11	2.47E-05	3.37E-08	1.81E-02
cis-1,2-Dichloroethene	---	---	---	---	---	---	---	381	NA	NA	NA	9.68E-05	NA	9.68E-05
Ethylbenzene	11	NA	1.17E-07	NA	3.93E-08	NA	2.50E-07	---	---	---	---	---	NA	4.06E-07
Isopropylbenzene	49	NA	5.17E-07	NA	1.72E-07	NA	8.62E-06	---	---	---	---	---	NA	9.31E-06
m,p-Xylene	11	NA	1.93E-08	NA	1.93E-09	NA	7.53E-07	---	---	---	---	---	NA	7.75E-07
Methylene chloride	48.4	5.42E-12	8.43E-07	1.81E-12	2.81E-07	2.17E-11	8.05E-06	---	---	---	---	---	2.89E-11	9.18E-06
n-Propylbenzene	69	NA	2.17E-06	NA	7.22E-07	NA	9.11E-06	71	NA	NA	NA	6.86E-06	NA	1.88E-05
p-Isopropyltoluene	42	NA	4.40E-07	NA	4.40E-08	NA	4.02E-07	---	---	---	---	---	NA	8.86E-07
sec-Butylbenzene	129	NA	1.13E-05	NA	1.13E-06	NA	1.33E-05	---	---	---	---	---	NA	2.56E-05
Toluene	49.8	NA	6.51E-08	NA	2.17E-07	NA	3.94E-07	---	---	---	---	---	NA	6.76E-07
Vinyl chloride	---	---	---	---	---	---	---	7.3	2.67E-08	8.20E-04	3.20E-11	2.62E-06	2.67E-08	8.23E-04
Xylenes, Total	40	NA	2.10E-07	NA	7.09E-08	NA	7.95E-06	---	---	---	---	---	NA	8.23E-06
Organics Total Risk		**2.20E-11**	**2.54E-05**	**7.34E-12**	**5.91E-06**	**1.35E-10**	**1.84E-04**		**6.02E-08**	**1.88E-02**	**8.43E-11**	**1.43E-04**	**6.05E-08**	**1.92E-02**
TPH-GRO	314,642	NA	NA	NA	1.29E-03	NA	1.33E-02	1,060	NA	NA	NA	9.35E-04	NA	1.56E-02
TPH-DRO	9,714	NA	6.43E-05	NA	5.86E-05	NA	1.34E-04	6,983	NA	NA	NA	1.98E-01	NA	1.99E-01
TPH-ORO	5,286	NA	4.04E-05	NA	3.12E-05	NA	7.86E-06	1,449	NA	NA	NA	1.09E-01	NA	1.09E-01
TPH Total Risk		**NA**	**1.05E-04**	**NA**	**1.38E-03**	**NA**	**1.35E-02**		**NA**	**NA**	**NA**	**3.09E-01**	**NA**	**3.23E-01**
Arsenic	---	---	---	---	---	---	---	100	NA	NA	NA	NA	NA	NA
Mercury	94	NA	1.09E-05	NA	1.10E-04	NA	3.16E-03	---	---	---	---	---	NA	3.28E-03
Metals Total Risk		**NA**	**1.09E-05**	**NA**	**1.10E-04**	**NA**	**3.16E-03**		**NA**	**NA**	**NA**	**NA**	**NA**	**3.28E-03**
CUMULATIVE RISK		**2.20E-11**	**1.41E-04**	**7.34E-12**	**1.49E-03**	**1.35E-10**	**1.68E-02**		**6.02E-08**	**1.88E-02**	**8.43E-11**	**3.09E-01**	**6.05E-08**	**3.46E-01**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
DRO: Diesel range organic
GRO: Gasoline range organic
ORO: Oil range organic
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter

Table 4B-10(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Future Construction Worker
Sub-area 3B: Retained Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc.	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ	(ug/L)	IELCR	HQ	IELCR	HQ		
Acetone	15	NA	1.52E-08	NA	5.28E-09	NA	9.04E-08	---	---	---	---	---	NA	1.11E-07
Benzene	414	2.16E-10	1.16E-04	7.19E-11	3.85E-05	1.47E-09	6.95E-04	---	---	---	---	---	1.76E-09	8.49E-04
Carbon disulfide	4.0	NA	4.18E-08	NA	2.23E-08	NA	7.92E-07	---	---	---	---	---	NA	8.56E-07
Ethylbenzene	32	NA	3.33E-07	NA	1.12E-07	NA	7.15E-07	---	---	---	---	---	NA	1.16E-06
Isopropylbenzene	3.3	NA	3.40E-08	NA	1.13E-08	NA	5.67E-07	---	---	---	---	---	NA	6.13E-07
n-Propylbenzene	2.7	NA	8.47E-08	NA	2.82E-08	NA	3.56E-07	6.1	NA	NA	NA	5.89E-07	NA	1.06E-06
sec-Butylbenzene	7.7	NA	6.71E-07	NA	6.71E-08	NA	7.90E-07	---	---	---	---	---	NA	1.53E-06
Toluene	140	NA	1.83E-07	NA	6.09E-07	NA	1.10E-06	---	---	---	---	---	NA	1.90E-06
Xylenes, Total	282	NA	1.48E-06	NA	4.98E-07	NA	5.58E-05	---	---	---	---	---	NA	5.78E-05
Organics Total Risk		**2.16E-10**	**1.18E-04**	**7.19E-11**	**3.99E-05**	**1.47E-09**	**7.55E-04**		**NA**	**NA**	**NA**	**5.89E-07**	**1.76E-09**	**9.14E-04**
Aliphatics > nC6 to nC8 (TX1006)	---	---	---	---	---	---	---	2,219	NA	NA	NA	1.86E-04	NA	1.86E-04
Aliphatics > nC8 to nC10 (TX1006)	---	---	---	---	---	---	---	555	NA	NA	NA	1.37E-03	NA	1.37E-03
Aromatics > nC8 to nC10 (TX1006)	---	---	---	---	---	---	---	555	NA	NA	NA	5.38E-05	NA	5.38E-05
TPH-GRO	**117,333**	**NA**	**NA**	**NA**	**5.33E-04**	**NA**	**6.91E-04**	**3,328**	**NA**	**NA**	**NA**	**1.61E-03**	**NA**	**2.83E-03**
Aliphatics > nC10 to nC12 (TX1006)	---	---	---	---	---	---	---	88	NA	NA	NA	3.26E-04	NA	3.26E-04
Aliphatics > nC12 to nC16 (TX1006)	---	---	---	---	---	---	---	88	NA	NA	NA	1.41E-03	NA	1.41E-03
Aliphatics > nC16 to nC21 (TX1006)	---	---	---	---	---	---	---	88	NA	NA	NA	1.33E-02	NA	1.33E-02
Aromatics > nC10 to nC12 (TX1006)	---	---	---	---	---	---	---	88	NA	NA	NA	3.92E-06	NA	3.92E-06
Aromatics > nC12 to nC16 (TX1006)	---	---	---	---	---	---	---	88	NA	NA	NA	2.71E-06	NA	2.71E-06
Aromatics > nC16 to nC21 (TX1006)	---	---	---	---	---	---	---	88	NA	NA	NA	2.07E-06	NA	2.07E-06
TPH-DRO	**11,514**	**NA**	**2.54E-05**	**NA**	**7.72E-05**	**NA**	**2.21E-05**	**529**	**NA**	**NA**	**NA**	**1.50E-02**	**NA**	**1.52E-02**
Aliphatics > nC21 to nC35 (TX1006)	---	---	---	---	---	---	---	136	NA	NA	NA	2.04E-02	NA	2.04E-02
Aromatics > nC21 to nC35 (TX1006)	---	---	---	---	---	---	---	136	NA	NA	NA	1.88E-06	NA	1.88E-06
TPH-ORO	**2,930**	**NA**	**7.46E-06**	**NA**	**1.92E-05**	**NA**	**6.05E-07**	**271**	**NA**	**NA**	**NA**	**2.04E-02**	**NA**	**2.04E-02**
TPH Total Risk		**NA**	**3.29E-05**	**NA**	**6.30E-04**	**NA**	**7.14E-04**		**NA**	**NA**	**NA**	**3.71E-02**	**NA**	**3.84E-02**
CUMULATIVE RISK		**2.16E-10**	**1.51E-04**	**7.19E-11**	**6.70E-04**	**1.47E-09**	**1.47E-03**		**NA**	**NA**	**NA**	**3.71E-02**	**1.76E-09**	**3.93E-02**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
DRO: Diesel range organic
GRO: Gasoline range organic
ORO: Oil range organic
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter

Table 4C-10(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Future Construction Worker
Sub-area 3C: Retained Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc. (ug/L)	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ		IELCR	HQ	IELCR	HQ		
Acetone	32	NA	3.35E-08	NA	1.17E-08	NA	2.00E-07	---	---	---	---	---	NA	2.45E-07
Benzene	79	4.10E-11	2.20E-05	1.37E-11	7.32E-06	2.79E-10	1.32E-04	120	5.82E-08	3.12E-02	9.08E-11	4.30E-05	5.86E-08	3.14E-02
Isopropylbenzene	17	NA	1.81E-07	NA	6.04E-08	NA	3.03E-06	---	---	---	---	---	NA	3.27E-06
Methylene chloride	22	2.44E-12	3.80E-07	8.15E-13	1.27E-07	9.78E-12	3.63E-06	---	---	---	---	---	1.30E-11	4.14E-06
Methyl tert-butyl ether	14	3.53E-13	1.74E-08	1.18E-13	5.81E-09	1.69E-12	1.52E-07	35	1.72E-10	8.49E-06	6.44E-13	5.76E-08	1.75E-10	8.73E-06
n-Butylbenzene	22	NA	1.95E-06	NA	1.95E-07	NA	1.71E-06	208	NA	NA	NA	2.38E-05	NA	2.77E-05
n-Propylbenzene	30	NA	9.31E-07	NA	3.10E-07	NA	3.91E-06	223	NA	NA	NA	2.15E-05	NA	2.67E-05
sec-Butylbenzene	24	NA	2.07E-06	NA	2.07E-07	NA	2.44E-06	172	NA	NA	NA	2.63E-05	NA	3.10E-05
t-Butylbenzene	5.7	NA	4.94E-07	NA	4.94E-08	NA	4.78E-07	---	---	---	---	---	NA	1.02E-06
Toluene	656	NA	8.58E-07	NA	2.86E-06	NA	5.19E-06	---	---	---	---	---	NA	8.91E-06
Xylenes, Total	259	NA	1.36E-06	NA	4.57E-07	NA	5.13E-05	---	---	---	---	---	NA	5.31E-05
Organics Total Risk		**4.38E-11**	**3.02E-05**	**1.46E-11**	**1.16E-05**	**2.90E-10**	**2.04E-04**		**5.84E-08**	**3.12E-02**	**9.14E-11**	**1.15E-04**	**5.88E-08**	**3.16E-02**
TPH-GRO	47,350	NA	NA	NA	1.94E-04	NA	2.01E-03	24,847	NA	NA	NA	3.36E-03	NA	5.56E-03
TPH-DRO	311,290	NA	2.06E-03	NA	1.88E-03	NA	4.30E-03	31,485	NA	NA	NA	1.44E-03	NA	9.68E-03
TPH-ORO	33,290	NA	2.54E-04	NA	1.96E-04	NA	4.95E-05	6.6	NA	NA	NA	4.68E-07	NA	5.01E-04
TPH Total Risk		**NA**	**2.31E-03**	**NA**	**2.27E-03**	**NA**	**6.36E-03**		**NA**	**NA**	**NA**	**4.80E-03**	**NA**	**1.57E-02**
CUMULATIVE RISK		**4.38E-11**	**2.34E-03**	**1.46E-11**	**2.28E-03**	**2.90E-10**	**6.56E-03**		**5.84E-08**	**3.12E-02**	**9.14E-11**	**4.92E-03**	**5.88E-08**	**4.73E-02**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
DRO: Diesel range organic
GRO: Gasoline range organic
ORO: Oil range organic
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter

Table 4D-10(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Future Construction Worker
Sub-area 3D: Retained Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc. (ug/L)	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ		IELCR	HQ	IELCR	HQ		
1,1-Dichloroethene	---	---	---	---	---	---	---	2.6	8.29E-09	2.15E-05	2.92E-11	2.05E-07	8.32E-09	2.17E-05
1,2,4-Trimethylbenzene	9,401	NA	1.97E-04	NA	6.56E-05	NA	1.00E-02	---	---	---	---	---	NA	1.03E-02
1,3,5-Trimethylbenzene	26	NA	5.39E-07	NA	1.80E-07	NA	6.91E-05	---	---	---	---	---	NA	6.98E-05
Benzene	6.1	3.19E-12	1.71E-06	1.06E-12	5.70E-07	2.17E-11	1.03E-05	2.1	1.03E-09	5.53E-04	7.23E-13	3.42E-07	1.06E-09	5.66E-04
Chloroethane	2.6	3.68E-13	2.22E-08	3.68E-14	2.22E-09	3.98E-12	3.32E-08	---	---	---	---	---	4.39E-12	5.76E-08
Ethylbenzene	8.1	NA	8.50E-08	NA	2.87E-08	NA	1.82E-07	---	---	---	---	---	NA	2.96E-07
Isopropylbenzene	81	NA	8.47E-07	NA	2.82E-07	NA	1.41E-05	---	---	---	---	---	NA	1.53E-05
m,p-Xylene	21	NA	3.71E-08	NA	3.71E-09	NA	1.44E-06	---	---	---	---	---	NA	1.49E-06
n-Butylbenzene	24	NA	2.07E-06	NA	2.07E-07	NA	4.79E-06	---	---	---	---	---	NA	7.07E-06
n-Propylbenzene	8.4	NA	2.63E-07	NA	8.76E-08	NA	1.11E-06	---	---	---	---	---	NA	1.46E-06
o-Xylene	3.9	NA	6.76E-09	NA	6.76E-10	NA	2.73E-08	---	---	---	---	---	NA	3.47E-08
p-Isopropyltoluene	76	NA	7.98E-07	NA	7.98E-08	NA	7.30E-07	---	---	---	---	---	NA	1.61E-06
sec-Butylbenzene	33	NA	2.84E-06	NA	2.84E-07	NA	3.35E-06	---	---	---	---	---	NA	6.48E-06
tert-Butylbenzene	27	NA	2.38E-06	NA	2.38E-07	NA	2.30E-06	---	---	---	---	---	NA	4.91E-06
Tetrachloroethene	4.1	3.28E-12	4.25E-08	1.09E-11	1.42E-07	1.79E-11	7.85E-07	6.2	1.06E-07	1.37E-03	4.82E-12	2.12E-07	1.06E-07	1.38E-03
Trichloroethene	---	---	---	---	---	---	---	3.3	4.67E-10	1.65E-05	6.30E-13	6.16E-08	4.68E-10	1.66E-05
Vinyl chloride	---	---	---	---	---	---	---	2.9	1.08E-08	3.32E-04	5.80E-12	4.75E-07	1.08E-08	3.33E-04
Xylenes, Total	12	NA	6.28E-08	NA	2.12E-08	NA	2.37E-06	---	---	---	---	---	NA	2.46E-06
Benzo(a)pyrene	85	4.02E-09	NA	3.15E-09	NA	3.39E-11	NA	---	---	---	---	---	7.21E-09	NA
Organics Total Risk		**4.03E-09**	**2.08E-04**	**3.17E-09**	**6.77E-05**	**7.74E-11**	**1.01E-02**		**1.27E-07**	**2.30E-03**	**4.11E-11**	**1.29E-06**	**1.34E-07**	**1.27E-02**
TPH-GRO	500	NA	NA	NA	2.05E-06	NA	2.12E-05	500	NA	NA	NA	1.97E-04	NA	2.20E-04
TPH-DRO	24,770	NA	1.64E-04	NA	1.49E-04	NA	3.42E-04	190	NA	NA	NA	2.41E-03	NA	3.07E-03
TPH-ORO	5,610	NA	4.29E-05	NA	3.31E-05	NA	8.34E-06	75	NA	NA	NA	2.53E-03	NA	2.61E-03
TPH Total Risk		**NA**	**2.07E-04**	**NA**	**1.85E-04**	**NA**	**3.72E-04**		**NA**	**NA**	**NA**	**5.14E-03**	**NA**	**5.90E-03**
Arsenic	11,294	2.53E-08	3.94E-03	8.82E-08	1.37E-02	1.07E-09	1.66E-05	25	NA	NA	NA	NA	1.15E-07	1.77E-02
Barium	---	---	---	---	---	---	---	1,978	NA	NA	NA	NA	NA	NA
Beryllium	470	2.01E-09	8.19E-06	2.01E-08	8.19E-05	2.49E-11	3.63E-05	---	---	---	---	---	2.22E-08	1.26E-04
Cadmium	269	NA	9.37E-07	NA	9.37E-05	1.07E-11	2.37E-07	8.2	NA	NA	NA	NA	1.07E-11	9.48E-05
Chromium	---	---	---	---	---	---	---	67	NA	NA	NA	NA	NA	NA
Copper	13,317	NA	1.16E-05	NA	1.16E-04	NA	2.05E-05	---	---	---	---	---	NA	1.48E-04
Manganese	---	---	---	---	---	---	---	2,156	NA	NA	NA	NA	NA	NA
Nickel	12,247	NA	1.07E-06	NA	2.14E-05	6.48E-11	9.46E-05	---	---	---	---	---	6.48E-11	1.17E-04
Selenium	1,293	NA	9.02E-06	NA	9.02E-05	NA	1.99E-04	---	---	---	---	---	NA	2.99E-04
Thallium	5,967	NA	2.60E-03	NA	2.60E-02	NA	3.29E-05	---	---	---	---	---	NA	2.86E-02
Zinc	39,892	NA	4.64E-06	NA	4.64E-05	NA	5.86E-08	---	---	---	---	---	NA	5.11E-05
Metals Total Risk		**2.73E-08**	**6.57E-03**	**1.08E-07**	**4.02E-02**	**1.17E-09**	**4.01E-04**		**NA**	**NA**	**NA**	**NA**	**1.37E-07**	**4.72E-02**
CUMULATIVE RISK		**3.14E-08**	**6.99E-03**	**1.11E-07**	**4.04E-02**	**1.24E-09**	**1.09E-02**		**1.27E-07**	**2.30E-03**	**4.11E-11**	**5.14E-03**	**2.71E-07**	**6.58E-02**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
DRO: Diesel range organic
GRO: Gasoline range organic
ORO: Oil range organic
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter

Table 4E-10(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Future Construction Worker
Sub-area 3E: Retained Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc. (ug/L)	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ		IELCR	HQ	IELCR	HQ		
1,2,4-Trimethylbenzene	---	---	---	---	---	---	---	2,500	NA	NA	NA	1.69E-03	NA	1.69E-03
Acetone	68	NA	7.11E-08	NA	2.48E-08	NA	4.24E-07	540	NA	NA	NA	2.47E-07	NA	7.67E-07
Benzene	202	1.05E-10	5.64E-05	3.50E-11	1.88E-05	7.15E-10	3.39E-04	---	---	---	---	---	8.55E-10	4.14E-04
Ethylbenzene	725	NA	7.58E-06	NA	2.56E-06	NA	1.63E-05	1,245	NA	4.28E-02	NA	6.00E-06	NA	4.29E-02
Isopropylbenzene	140	NA	1.46E-06	NA	4.88E-07	NA	2.44E-05	---	---	---	---	---	NA	2.64E-05
Methylene chloride	39	1.07E-12	1.67E-07	3.58E-13	5.57E-08	4.30E-12	1.60E-06	---	---	---	---	---	5.73E-12	1.82E-06
Methyl tert-butyl ether	10	1.00E-12	4.95E-08	3.35E-13	1.65E-08	4.82E-12	4.31E-07	---	---	---	---	---	6.16E-12	4.97E-07
m,p-Xylene	---	---	---	---	---	---	---	5,300	NA	9.86E-03	NA	5.59E-05	NA	9.91E-03
Naphthalene	206	NA	4.31E-06	NA	4.31E-06	NA	1.51E-04	930	NA	NA	NA	4.89E-04	NA	6.48E-04
n-Butylbenzene	131	NA	1.14E-05	NA	1.14E-06	NA	9.98E-06	---	---	---	---	---	NA	2.25E-05
n-Propylbenzene	453	NA	1.42E-05	NA	4.74E-06	NA	5.98E-05	380	NA	NA	NA	1.63E-05	NA	9.50E-05
sec-Butylbenzene	52	NA	4.53E-06	NA	4.53E-07	NA	5.33E-06	---	---	---	---	---	NA	1.03E-05
Toluene	115	NA	1.50E-07	NA	5.01E-07	NA	9.10E-07	---	---	---	---	---	NA	1.56E-06
Xylenes, Total	1,533	NA	8.02E-06	NA	2.71E-06	NA	3.03E-04	---	---	---	---	---	NA	3.14E-04
Organics Total Risk		**1.07E-10**	**1.08E-04**	**3.57E-11**	**3.58E-05**	**7.24E-10**	**9.12E-04**		**NA**	**5.27E-02**	**NA**	**2.26E-03**	**8.67E-10**	**5.60E-02**
Aliphatics > nC6 to nC8 (TX1006)	---	---	---	---	---	---	---	4,917	NA	NA	NA	1.83E-04	NA	1.83E-04
Aliphatics > nC8 to nC10 (TX1006)	---	---	---	---	---	---	---	4,917	NA	NA	NA	5.38E-03	NA	5.38E-03
Aromatics > nC8 to nC10 (TX1006)	---	---	---	---	---	---	---	19,667	NA	NA	NA	8.47E-04	NA	8.47E-04
TPH-GRO	**180,057**	**NA**	**NA**	**NA**	**8.19E-04**	**NA**	**1.06E-03**	**29,500**	**NA**	**NA**	**NA**	**6.41E-03**	**NA**	**8.29E-03**
Aliphatics > nC10 to nC12 (TX1006)	---	---	---	---	---	---	---	8,338	NA	NA	NA	1.37E-02	NA	1.37E-02
Aliphatics > nC12 to nC16 (TX1006)	---	---	---	---	---	---	---	8,338	NA	NA	NA	5.92E-02	NA	5.92E-02
Aliphatics > nC16 to nC21 (TX1006)	---	---	---	---	---	---	---	8,338	NA	NA	NA	5.58E-01	NA	5.58E-01
Aromatics > nC10 to nC12 (TX1006)	---	---	---	---	---	---	---	8,338	NA	NA	NA	1.64E-04	NA	1.64E-04
Aromatics > nC12 to nC16 (TX1006)	---	---	---	---	---	---	---	8,338	NA	NA	NA	1.14E-04	NA	1.14E-04
Aromatics > nC16 to nC21 (TX1006)	---	---	---	---	---	---	---	8,338	NA	NA	NA	8.56E-05	NA	8.56E-05
TPH-DRO	**5,304**	**NA**	**1.17E-05**	**NA**	**3.56E-05**	**NA**	**1.02E-05**	**50,025**	**NA**	**NA**	**NA**	**6.31E-01**	**NA**	**6.31E-01**
Aliphatics > nC21 to nC35 (TX1006)	---	---	---	---	---	---	---	373	NA	NA	NA	2.50E-02	NA	2.50E-02
Aromatics > nC21 to nC35 (TX1006)	---	---	---	---	---	---	---	4,477	NA	NA	NA	2.56E-05	NA	2.56E-05
TPH-ORO	**5,455**	**NA**	**1.39E-05**	**NA**	**3.58E-05**	**NA**	**1.13E-06**	**4,850**	**NA**	**NA**	**NA**	**2.50E-02**	**NA**	**2.50E-02**
TPH Total Risk		**NA**	**2.56E-05**	**NA**	**8.90E-04**	**NA**	**1.07E-03**		**NA**	**NA**	**NA**	**6.62E-01**	**NA**	**6.64E-01**
CUMULATIVE RISK		**1.07E-10**	**1.34E-04**	**3.57E-11**	**9.26E-04**	**7.24E-10**	**1.98E-03**		**NA**	**5.27E-02**	**NA**	**6.65E-01**	**8.67E-10**	**7.20E-01**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
DRO: Diesel range organic
GRO: Gasoline range organic
ORO: Oil range organic
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter

Table 4F-10(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Future Construction Worker
Sub-area 3F: Retained Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc. (ug/kg)	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc. (ug/L)	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
		IELCR	HQ	IELCR	HQ	IELCR	HQ		IELCR	HQ	IELCR	HQ		
TPH-GRO	---	---	---	---	---	---	---	500	NA	NA	NA	1.97E-04	NA	1.97E-04
TPH-DRO	---	---	---	---	---	---	---	514	NA	NA	NA	6.53E-03	NA	6.53E-03
TPH-ORO	---	---	---	---	---	---	---	1,543	NA	NA	NA	5.20E-02	NA	5.20E-02
TPH Total Risk		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**		**NA**	**NA**	**NA**	**5.87E-02**	**NA**	**5.87E-02**
CUMULATIVE RISK		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**		**NA**	**NA**	**NA**	**5.87E-02**	**NA**	**5.87E-02**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
DRO: Diesel range organic
GRO: Gasoline range organic
ORO: Oil range organic
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter

Table 4G-10(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Future Construction Worker
Sub-area 3G: Retained Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc. (ug/L)	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ		IELCR	HQ	IELCR	HQ		
1,2,4-Trimethylbenzene	840	NA	1.76E-05	NA	5.86E-06	NA	8.95E-04	5.5	NA	NA	NA	3.77E-06	NA	9.22E-04
1,3,5-Trimethylbenzene	326	NA	6.83E-06	NA	2.28E-06	NA	8.75E-04	---	---	---	---	---	NA	8.84E-04
Acetone	820	NA	8.58E-07	NA	2.99E-07	NA	5.11E-06	---	---	---	---	---	NA	6.27E-06
Benzene	548	2.85E-10	1.53E-04	9.50E-11	5.09E-05	1.94E-09	9.18E-04	484	2.35E-07	1.26E-01	1.65E-10	7.79E-05	2.37E-07	1.27E-01
Ethylbenzene	1,010	NA	1.06E-05	NA	3.56E-06	NA	2.27E-05	---	---	---	---	---	NA	3.68E-05
m,p-Xylene	2,650	NA	4.62E-06	NA	4.62E-07	NA	1.80E-04	---	---	---	---	---	NA	1.85E-04
Methyl tert-butyl ether	378	9.32E-12	4.60E-07	3.11E-12	1.53E-07	4.47E-11	4.00E-06	---	---	---	---	---	5.72E-11	4.61E-06
Naphthalene	478	NA	9.99E-06	NA	9.99E-06	NA	3.50E-04	---	---	---	---	---	NA	3.70E-04
o-Xylene	1,490	NA	2.60E-06	NA	2.60E-07	NA	1.05E-05	---	---	---	---	---	NA	1.34E-05
p-Isopropyltoluene	416	NA	4.35E-06	NA	4.35E-07	NA	3.98E-06	---	---	---	---	---	NA	8.77E-06
Toluene	5,700	NA	7.45E-06	NA	2.48E-05	NA	4.51E-05	---	---	---	---	---	NA	7.74E-05
Xylenes, Total	3,550	NA	1.86E-05	NA	6.26E-06	NA	7.02E-04	---	---	---	---	---	NA	7.27E-04
Organics Total Risk		**2.94E-10**	**2.37E-04**	**9.81E-11**	**1.05E-04**	**1.98E-09**	**4.01E-03**		**2.35E-07**	**1.26E-01**	**1.65E-10**	**8.16E-05**	**2.37E-07**	**1.30E-01**
Aliphatics > nC6 to nC8 (TX1006)	---	---	---	---	---	---	---	1,680	NA	NA	NA	6.30E-05	NA	6.30E-05
Aliphatics > nC8 to nC10 (TX1006)	---	---	---	---	---	---	---	1,680	NA	NA	NA	1.85E-03	NA	1.85E-03
Aromatics > nC8 to nC10 (TX1006)	---	---	---	---	---	---	---	1,680	NA	NA	NA	7.31E-05	NA	7.31E-05
TPH-GRO	**3,280**	**NA**	**NA**	**NA**	**1.49E-05**	**NA**	**1.93E-05**	**5,040**	**NA**	**NA**	**NA**	**1.99E-03**	**NA**	**2.02E-03**
Aliphatics > nC10 to nC12 (TX1006)	---	---	---	---	---	---	---	222	NA	NA	NA	3.67E-04	NA	3.67E-04
Aliphatics > nC12 to nC16 (TX1006)	---	---	---	---	---	---	---	889	NA	NA	NA	6.36E-03	NA	6.36E-03
Aliphatics > nC16 to nC21 (TX1006)	---	---	---	---	---	---	---	222	NA	NA	NA	1.50E-02	NA	1.50E-02
Aromatics > nC10 to nC12 (TX1006)	---	---	---	---	---	---	---	222	NA	NA	NA	4.45E-06	NA	4.45E-06
Aromatics > nC12 to nC16 (TX1006)	---	---	---	---	---	---	---	222	NA	NA	NA	3.11E-06	NA	3.11E-06
Aromatics > nC16 to nC21 (TX1006)	---	---	---	---	---	---	---	222	NA	NA	NA	2.48E-06	NA	2.48E-06
TPH-DRO	**85,750**	**NA**	**1.89E-04**	**NA**	**5.75E-04**	**NA**	**1.65E-04**	**2,000**	**NA**	**NA**	**NA**	**2.17E-02**	**NA**	**2.26E-02**
Aliphatics > nC21 to nC35 (TX1006)	---	---	---	---	---	---	---	2,432	NA	NA	NA	1.64E-01	NA	1.64E-01
Aromatics > nC21 to nC35 (TX1006)	---	---	---	---	---	---	---	608	NA	NA	NA	5.76E-06	NA	5.76E-06
TPH-ORO	**1,470,000**	**NA**	**3.75E-03**	**NA**	**9.64E-03**	**NA**	**3.04E-04**	**3,040**	**NA**	**NA**	**NA**	**1.64E-01**	**NA**	**1.78E-01**
TPH Total Risk		**NA**	**3.93E-03**	**NA**	**1.02E-02**	**NA**	**4.87E-04**		**NA**	**NA**	**NA**	**1.88E-01**	**NA**	**2.02E-01**
CUMULATIVE RISK		**2.94E-10**	**4.17E-03**	**9.81E-11**	**1.03E-02**	**1.98E-09**	**4.50E-03**		**2.35E-07**	**1.26E-01**	**1.65E-10**	**1.88E-01**	**2.37E-07**	**3.33E-01**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
DRO: Diesel range organic
GRO: Gasoline range organic
ORO: Oil range organic
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter

Table 4H-10(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Future Construction Worker
Sub-area 3H: Retained Area, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc. (ug/L)	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ		IELCR	HQ	IELCR	HQ		
Acetone	21	NA	2.20E-08	NA	7.65E-09	NA	1.31E-07	---	---	---	---	---	NA	1.61E-07
Methyl ethyl ketone (MEK)	8.8	NA	1.53E-08	NA	5.11E-09	NA	2.85E-08	---	---	---	---	---	NA	4.90E-08
Methylene chloride	4.5	5.04E-13	7.85E-08	1.68E-13	2.62E-08	2.02E-12	7.50E-07	---	---	---	---	---	2.69E-12	8.54E-07
Xylenes, total	6.0	NA	3.11E-08	NA	1.05E-08	NA	1.18E-06	---	---	---	---	---	NA	1.22E-06
Organics Total Risk		**5.04E-13**	**1.47E-07**	**1.68E-13**	**4.94E-08**	**2.02E-12**	**2.09E-06**		**NA**	**NA**	**NA**	**NA**	**2.69E-12**	**2.28E-06**
TPH-GRO	375	NA	NA	NA	1.53E-06	NA	1.59E-05	275	NA	NA	NA	3.59E-05	NA	5.33E-05
TPH-DRO	36,120	NA	2.39E-04	NA	2.18E-04	NA	4.99E-04	2,520	NA	NA	NA	3.18E-02	NA	3.27E-02
TPH-ORO	3,159	NA	2.41E-05	NA	1.86E-05	NA	4.70E-06	213	NA	NA	NA	7.12E-03	NA	7.17E-03
TPH Total Risk		**NA**	**2.63E-04**	**NA**	**2.38E-04**	**NA**	**5.20E-04**		**NA**	**NA**	**NA**	**3.89E-02**	**NA**	**4.00E-02**
Arsenic	---	---	---	---	---	---	---	80	NA	NA	NA	NA	NA	NA
Manganese	---	---	---	---	---	---	---	8,860	NA	NA	NA	NA	NA	NA
Metals Total Risk		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
CUMULATIVE RISK		**5.04E-13**	**2.63E-04**	**1.68E-13**	**2.38E-04**	**2.02E-12**	**5.22E-04**		**NA**	**NA**	**NA**	**3.89E-02**	**2.69E-12**	**4.00E-02**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
DRO: Diesel range organic
GRO: Gasoline range organic
ORO: Oil range organic
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter

Table 5-9(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Futue Construction Worker
Area 4: Power Plant, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc. (ug/L)	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ		IELCR	HQ	IELCR	HQ		
Acetone	22	NA	2.34E-08	NA	8.14E-09	NA	1.39E-07	---	---	---	---	---	NA	1.71E-07
Methyl ethyl ketone (MEK)	6.3	NA	1.10E-08	NA	3.66E-09	NA	2.04E-08	---	---	---	---	---	NA	3.51E-08
Methylene chloride	3.3	3.67E-13	5.70E-08	1.22E-13	1.90E-08	1.47E-12	5.45E-07	---	---	---	---	---	1.96E-12	6.21E-07
Toluene	5.0	NA	6.49E-09	NA	2.16E-08	NA	3.92E-08	---	---	---	---	---	NA	6.73E-08
Xylenes, total	4.2	NA	4.92E-09	NA	1.35E-08	NA	5.58E-07	---	---	---	---	---	NA	5.77E-07
Anthracene	3.0	NA	4.16E-09	NA	3.46E-09	NA	1.49E-09	---	---	---	---	---	NA	9.11E-09
Benzo(a)anthracene	5.1	2.41E-11	NA	1.85E-11	NA	3.26E-13	NA	5.5	2.16E-06	NA	6.60E-12	NA	2.16E-06	NA
Benzo(a)pyrene	7.5	3.55E-10	NA	2.79E-10	NA	2.99E-12	NA	---	---	---	---	---	6.37E-10	NA
Benzo(b)fluoranthene	28	1.34E-10	NA	1.03E-10	NA	1.38E-12	NA	5.4	3.16E-06	NA	6.41E-12	NA	3.16E-06	NA
Benzo(g,h,i)perylene	13	NA	1.56E-06	NA	1.56E-07	NA	6.61E-09	---	---	---	---	---	NA	1.73E-06
Benzo(k)fluoranthene	2.8	1.31E-12	NA	1.01E-12	NA	8.53E-14	NA	---	---	---	---	---	2.41E-12	NA
Chrysene	7.1	3.37E-13	NA	2.59E-13	NA	6.33E-14	NA	---	---	---	---	---	6.59E-13	NA
Dibenzo(a,h)anthracene	35	1.65E-09	NA	1.27E-09	NA	7.05E-12	NA	---	---	---	---	---	2.92E-09	NA
Fluoranthene	11	NA	1.21E-07	NA	9.34E-08	NA	5.86E-09	---	---	---	---	---	NA	2.21E-07
Indeno(1,2,3-cd)pyrene	5.9	4.44E-11	NA	3.41E-11	NA	1.08E-13	NA	---	---	---	---	---	7.86E-11	NA
Phenanthrene	24	NA	2.83E-06	NA	2.83E-07	NA	8.62E-08	---	---	---	---	---	NA	3.20E-06
Pyrene	21	NA	3.10E-07	NA	2.39E-07	NA	1.51E-08	---	---	---	---	---	NA	5.64E-07
Carbazole	---	---	---	---	---	---	---	6.4	NA	NA	3.09E-13	NA	3.09E-13	NA
Organics Total Risk		**2.21E-09**	**4.93E-06**	**1.70E-09**	**8.41E-07**	**1.35E-11**	**1.42E-06**		**5.32E-06**	**NA**	**1.33E-11**	**NA**	**5.33E-06**	**7.19E-06**
TPH-GRO	375	NA	NA	NA	1.53E-06	NA	1.59E-05	388	NA	NA	NA	1.52E-04	NA	1.69E-04
TPH-DRO	36,120	NA	2.39E-04	NA	2.18E-04	NA	4.99E-04	1,683	NA	NA	NA	2.12E-02	NA	2.22E-02
TPH-ORO	3,159	NA	2.41E-05	NA	1.86E-05	NA	4.70E-06	238	NA	NA	NA	7.97E-03	NA	8.02E-03
TPH Total Risk		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**		**NA**	**NA**	**NA**	**2.94E-02**	**NA**	**3.04E-02**
Arsenic	7,508	1.68E-08	2.62E-03	5.33E-08	8.29E-03	7.10E-10	1.10E-05	48	NA	NA	NA	NA	7.08E-08	1.09E-02
Manganese	---	---	---	---	---	---	---	4,864	NA	NA	NA	NA	NA	NA
Selenium	1,262	NA	8.80E-06	NA	8.80E-05	NA	1.95E-04	---	---	---	---	---	NA	2.91E-04
Metals Total Risk		**1.68E-08**	**2.63E-03**	**5.33E-08**	**8.38E-03**	**7.10E-10**	**2.06E-04**		**NA**	**NA**	**NA**	**NA**	**7.08E-08**	**1.12E-02**
CUMULATIVE RISK		**1.90E-08**	**2.63E-03**	**5.50E-08**	**8.38E-03**	**7.23E-10**	**2.07E-04**		**5.32E-06**	**NA**	**1.33E-11**	**2.94E-02**	**5.40E-06**	**4.16E-02**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
GRO: Gasoline range organic
DRO: Diesel range organic
ORO: Oil range organic
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter

Table 6-8(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Futue Construction Worker
Area 5: IWTP, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc. (ug/L)	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ		IELCR	HQ	IELCR	HQ		
TPH-GRO	93,000	NA	NA	NA	3.81E-04	NA	2.16E-03	---	---	---	---	---	NA	2.54E-03
TPH-DRO	200,000	NA	1.32E-03	NA	1.21E-03	NA	1.54E-03	---	---	---	---	---	NA	4.07E-03
TPH Total Risk		**NA**	**1.32E-03**	**NA**	**1.59E-03**	**NA**	**3.69E-03**		**NA**	**NA**	**NA**	**NA**	**NA**	**6.60E-03**
Arsenic	8,042	1.80E-08	2.80E-03	6.28E-08	9.77E-03	7.60E-10	1.18E-05	---	---	---	---	---	8.16E-08	1.26E-02
Chromium	---	---	---	---	---	---	---	170	NA	NA	NA	NA	NA	NA
Mercury	62	NA	7.20E-06	NA	7.23E-05	NA	2.08E-03	---	---	---	---	---	NA	2.16E-03
Nickel	13,050	NA	1.14E-06	NA	2.28E-05	6.91E-11	1.01E-04	---	---	---	---	---	6.91E-11	1.25E-04
Selenium	1,170	NA	8.16E-06	NA	8.16E-05	NA	9.07E-06	---	---	---	---	---	NA	9.89E-05
Cyanide, total	641	NA	NA	NA	NA	NA	NA	---	---	---	---	---	NA	NA
Organics Total Risk		**1.80E-08**	**2.82E-03**	**6.28E-08**	**9.95E-03**	**8.29E-10**	**2.20E-03**		**NA**	**NA**	**NA**	**NA**	**8.17E-08**	**1.50E-02**
CUMULATIVE RISK		**1.80E-08**	**4.14E-03**	**6.28E-08**	**1.15E-02**	**8.29E-10**	**5.90E-03**		**NA**	**NA**	**NA**	**NA**	**8.17E-08**	**2.16E-02**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
DRO: Diesel range organic
GRO: Gasoline range organic
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter

Table 7A-10(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Future Construction Worker
Sub-area 6A: GKN Facility, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc. (ug/L)	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ		IELCR	HQ	IELCR	HQ		
Acetone	30.5	NA	3.19E-08	NA	1.11E-08	NA	1.90E-07	---	---	---	---	---	NA	2.33E-07
Benzene	---	---	---	---	---	---	---	0.76	3.69E-10	1.98E-04	2.57E-13	1.21E-07	3.69E-10	1.98E-04
Chrysene	1,500	7.09E-11	NA	5.46E-11	NA	1.33E-11	NA	---	---	---	---	---	1.39E-10	NA
Methyl ethyl ketone (MEK)	17.5	NA	3.05E-08	NA	1.02E-08	NA	5.67E-08	---	---	---	---	---	NA	9.74E-08
Organics Total Risk		**7.09E-11**	**6.24E-08**	**5.46E-11**	**2.13E-08**	**1.33E-11**	**2.47E-07**		**3.69E-10**	**1.98E-04**	**2.57E-13**	**1.21E-07**	**5.08E-10**	**1.98E-04**
TPH-GRO	---	---	---	---	---	---	---	730	NA	NA	NA	2.87E-04	NA	2.87E-04
TPH-DRO	---	---	---	---	---	---	---	250	NA	NA	NA	3.16E-03	NA	3.16E-03
TPH Total Risk		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**		**NA**	**NA**	**NA**	**3.45E-03**	**NA**	**3.45E-03**
Arsenic	6,700	1.50E-08	2.34E-03	5.23E-08	8.14E-03	6.33E-10	9.85E-06	102	NA	NA	NA	NA	6.80E-08	1.05E-02
Barium	---	---	---	---	---	---	---	11,567	NA	NA	NA	NA	NA	NA
Cadmium	---	---	---	---	---	---	---	7.5	NA	NA	NA	NA	NA	NA
Chromium	---	---	---	---	---	---	---	539	NA	NA	NA	NA	NA	NA
Selenium	353	NA	2.46E-06	NA	2.46E-05	NA	2.73E-06	---	---	---	---	---	NA	2.98E-05
Metals Total Risk		**1.50E-08**	**2.34E-03**	**5.23E-08**	**8.16E-03**	**6.33E-10**	**1.26E-05**		**NA**	**NA**	**NA**	**NA**	**6.80E-08**	**1.05E-02**
CUMULATIVE RISK		**1.51E-08**	**2.34E-03**	**5.24E-08**	**8.16E-03**	**6.46E-10**	**1.28E-05**		**3.69E-10**	**1.98E-04**	**2.57E-13**	**3.45E-03**	**6.85E-08**	**1.42E-02**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
GRO: Gasoline range organic
ug/L: Micrograms per liter
ug/kg: Micrograms per kilogram

Table 7B-10(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Future Construction Worker
Sub-area 6B: GKN Facility, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc. (ug/L)	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ		IELCR	HQ	IELCR	HQ		
1,1-Dichloroethane	3.0	NA	1.06E-07	NA	1.06E-08	NA	3.75E-06	---	---	---	---	---	NA	3.87E-06
1,1-Dichloroethene	2.9	2.58E-11	6.70E-08	8.61E-12	2.23E-08	2.24E-10	1.57E-06	8.0	5.08E-08	1.32E-04	1.66E-10	1.17E-06	5.12E-08	1.35E-04
1,1,2-Trichloro-1,2,2-trifluoroethane	---	---	---	---	---	---	---	640	NA	NA	NA	3.46E-06	NA	3.46E-06
1,2,3-Trimethylbenzene	---	---	---	---	---	---	---	0.7	NA	NA	NA	6.34E-07	NA	6.34E-07
1,2,4-Trimethylbenzene	---	---	---	---	---	---	---	3.4	NA	NA	NA	4.27E-06	NA	4.27E-06
Acetone	30	NA	3.10E-08	NA	1.08E-08	NA	1.85E-07	---	---	---	---	---	NA	2.27E-07
Benzene	---	---	---	---	---	---	---	13	6.46E-09	3.47E-03	8.40E-12	3.97E-06	6.47E-09	3.47E-03
Bromomethane	---	---	---	---	---	---	---	14	NA	1.65E-03	NA	2.68E-05	NA	1.68E-03
cis-1,2-Dichloroethene	87	NA	9.05E-07	NA	3.02E-06	NA	1.22E-04	582	NA	NA	NA	1.23E-04	NA	2.49E-04
Dichlorodifluoromethane	---	---	---	---	---	---	---	35	NA	9.79E-05	NA	1.55E-05	NA	1.13E-04
Ethylbenzene	63	NA	6.55E-07	NA	2.21E-07	NA	1.41E-06	---	---	---	---	---	NA	2.28E-06
Methyl ethyl ketone (MEK)	11.8	NA	2.05E-08	NA	6.84E-09	NA	3.81E-08	---	---	---	---	---	NA	6.55E-08
Methyl tert-butyl ether (MTBE)	---	---	---	---	---	---	---	32	1.56E-10	7.68E-06	4.85E-13	4.34E-08	1.56E-10	7.72E-06
Methylene chloride	6.2	6.96E-13	1.08E-07	2.32E-13	3.61E-08	2.79E-12	1.03E-06	13	4.41E-09	6.87E-04	5.84E-13	2.17E-07	4.42E-09	6.88E-04
Tetrachloroethene	5.47	4.42E-12	5.72E-08	1.47E-11	1.91E-07	2.41E-11	1.06E-06	20	3.37E-07	4.37E-03	2.85E-11	1.25E-06	3.37E-07	4.37E-03
Toluene	2,448	NA	3.20E-06	NA	1.07E-05	NA	1.94E-05	---	---	---	---	---	NA	3.32E-05
trans-1,2-Dichlorobenzene	9	NA	1.04E-07	NA	1.73E-08	NA	3.73E-07	---	---	---	---	---	NA	4.94E-07
trans-1,2-Dichloroethene	36	NA	1.88E-07	NA	6.28E-07	NA	3.13E-05	58	NA	NA	NA	9.59E-06	NA	4.17E-05
Trichloroethene	21	6.87E-15	2.43E-10	1.37E-12	4.86E-08	2.39E-11	2.34E-06	112	1.57E-08	5.55E-04	3.93E-11	3.85E-06	1.58E-08	5.61E-04
Vinyl chloride	27	3.05E-13	9.35E-09	1.02E-10	3.12E-06	6.15E-10	5.03E-05	149	5.48E-07	1.68E-02	5.48E-10	4.48E-05	5.49E-07	1.69E-02
Xylenes, Total	202	NA	1.06E-06	NA	3.57E-07	NA	4.00E-05	---	---	---	---	---	NA	4.14E-05
Aroclor 1254	100	1.39E-09	2.44E-03	9.96E-10	1.74E-03	1.26E-12	2.20E-06	296	NA	NA	NA	NA	2.39E-09	4.19E-03
Acenaphthene	721	NA	5.03E-06	NA	4.19E-06	NA	2.10E-06	---	---	---	---	---	NA	1.13E-05
Acenaphthylene	29	NA	1.69E-06	NA	1.69E-07	NA	7.69E-08	---	---	---	---	---	NA	1.93E-06
Benzo(a)anthracene	103	4.87E-10	NA	3.75E-10	NA	6.60E-12	NA	126	4.96E-05	NA	3.11E-10	NA	4.96E-05	NA
Benzo(b)fluoranthene	102	4.82E-10	NA	3.71E-10	NA	4.98E-12	NA	---	---	---	---	---	8.58E-10	NA
Chrysene	159	7.52E-12	NA	5.78E-12	NA	1.41E-12	NA	---	---	---	---	---	1.47E-11	NA
Fluoranthene	146	NA	1.65E-06	NA	1.27E-06	NA	7.98E-08	---	---	---	---	---	NA	3.01E-06
Fluorene	109	NA	1.14E-06	NA	9.50E-07	NA	2.40E-07	---	---	---	---	---	NA	2.33E-06
Phenanthrene	17	NA	1.98E-06	NA	1.98E-07	NA	6.02E-08	---	---	---	---	---	NA	2.23E-06
Pyrene	136	NA	2.06E-06	NA	1.58E-06	NA	1.00E-07	---	---	---	---	---	NA	3.74E-06
Organics Total Risk		**2.40E-09**	**2.46E-03**	**1.87E-09**	**1.77E-03**	**9.04E-10**	**2.80E-04**		**5.05E-05**	**2.78E-02**	**1.10E-09**	**2.39E-04**	**5.06E-05**	**3.25E-02**
Aliphatics > nC6 to nC8 (TX1006)	---	---	---	---	---	---	---	885	NA	NA	NA	6.19E-05	NA	6.19E-05
Aliphatics > nC8 to nC10 (TX1006)	---	---	---	---	---	---	---	55	NA	NA	NA	1.14E-04	NA	1.14E-04
Aromatics > nC8 to nC10 (TX1006)	---	---	---	---	---	---	---	55	NA	NA	NA	4.48E-06	NA	4.48E-06
TPH-GRO	**1,835**	**NA**	**NA**	**NA**	**8.34E-06**	**NA**	**1.08E-05**	**996**	**NA**	**NA**	**NA**	**1.80E-04**	**NA**	**1.99E-04**
Aliphatics > nC10 to nC12 (TX1006)	---	---	---	---	---	---	---	5,575	NA	NA	NA	1.72E-02	NA	1.72E-02
Aliphatics > nC12 to nC16 (TX1006)	---	---	---	---	---	---	---	5,575	NA	NA	NA	7.43E-02	NA	7.43E-02
Aliphatics > nC16 to nC21 (TX1006)	---	---	---	---	---	---	---	5,575	NA	NA	NA	7.00E-01	NA	7.00E-01
Aromatics > nC10 to nC12 (TX1006)	---	---	---	---	---	---	---	5,575	NA	NA	NA	2.07E-04	NA	2.07E-04
Aromatics > nC12 to nC16 (TX1006)	---	---	---	---	---	---	---	5,575	NA	NA	NA	1.43E-04	NA	1.43E-04
Aromatics > nC16 to nC21 (TX1006)	---	---	---	---	---	---	---	5,575	NA	NA	NA	1.09E-04	NA	1.09E-04
TPH-DRO	**137,545**	**NA**	**3.03E-04**	**NA**	**9.22E-04**	**NA**	**2.64E-04**	**33,451**	**NA**	**NA**	**NA**	**7.92E-01**	**NA**	**7.93E-01**
Aliphatics > nC21 to nC35 (TX1006)	---	---	---	---	---	---	---	75	NA	NA	NA	9.42E-03	NA	9.42E-03
Aromatics > nC21 to nC35 (TX1006)	---	---	---	---	---	---	---	75	NA	NA	NA	8.66E-07	NA	8.66E-07
TPH-ORO	**---**	---	---	---	---	---	---	**150**	**NA**	**NA**	**NA**	**9.42E-03**	**NA**	**9.42E-03**
TPH Total Risk		**NA**	**3.03E-04**	**NA**	**9.31E-04**	**NA**	**2.75E-04**		**NA**	**NA**	**NA**	**8.02E-01**	**NA**	**8.03E-01**

Table 7B-10(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Future Construction Worker
Sub-area 6B: GKN Facility, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc. (ug/L)	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ		IELCR	HQ	IELCR	HQ		
Arsenic	14,266	3.20E-08	4.97E-03	1.11E-07	1.73E-02	1.35E-09	2.10E-05	108	NA	NA	NA	NA	1.45E-07	2.23E-02
Barium	---	---	---	---	---	---	---	5,440	NA	NA	NA	NA	NA	NA
Cadmium	481	NA	1.68E-06	NA	1.68E-04	1.91E-11	4.25E-07	1,177	NA	NA	NA	NA	1.91E-11	1.70E-04
Chromium	---	---	---	---	---	---	---	412	NA	NA	NA	NA	NA	NA
Mercury	42	NA	4.94E-06	NA	4.96E-05	NA	1.43E-03	1.2	NA	NA	NA	2.37E-05	NA	1.51E-03
Selenium	920	NA	6.42E-06	NA	6.42E-05	NA	7.12E-06	---	---	---	---	---	NA	7.77E-05
Antimony	3,964	NA	3.46E-04	NA	3.46E-03	NA	1.23E-04	---	---	---	---	---	NA	3.92E-03
Beryllium	937	4.01E-09	1.63E-05	4.01E-08	1.63E-06	4.96E-11	7.24E-05	---	---	---	---	---	4.42E-08	9.03E-05
Cobalt	8,404	NA	1.47E-03	NA	1.47E-04	5.19E-10	6.50E-04	---	---	---	---	---	5.19E-10	2.26E-03
Copper	19,350	NA	1.69E-05	NA	1.69E-04	NA	2.98E-05	---	---	---	---	---	NA	2.15E-04
Manganese	1,084,100	NA	2.43E-04	NA	2.70E-03	NA	3.41E-02	6,400	NA	NA	NA	NA	NA	3.71E-02
Nickel	28,150	NA	2.45E-06	NA	4.91E-05	1.49E-10	2.17E-04	---	---	---	---	---	1.49E-10	2.69E-04
Zinc	52,140	NA	6.06E-06	NA	6.06E-05	NA	7.66E-08	---	---	---	---	---	NA	6.67E-05
Metals Total Risk		**3.60E-08**	**7.08E-03**	**1.52E-07**	**2.42E-02**	**2.08E-09**	**3.67E-02**		**NA**	**NA**	**NA**	**2.37E-05**	**1.90E-07**	**6.80E-02**
CUMULATIVE RISK		**3.84E-08**	**9.85E-03**	**1.53E-07**	**2.69E-02**	**2.99E-09**	**3.73E-02**		**5.05E-05**	**2.78E-02**	**1.10E-09**	**8.02E-01**	**5.07E-05**	**9.04E-01**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
GRO: Gasoline range organic
DRO: Diesel range organic
ORO: Oil range organic
ug/L: Micrograms per liter
ug/kg: Micrograms per kilogram

Table 7C-10(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Future Construction Worker
Sub-area 6C: GKN Facility, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc. (ug/L)	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ		IELCR	HQ	IELCR	HQ		
2-Hexanone (MBK)	---	---	---	---	---	---	---	4.3	NA	NA	NA	1.28E-06	NA	1.28E-06
Acetone	27	NA	2.81E-08	NA	9.78E-09	NA	1.67E-07	---	---	---	---	---	NA	2.05E-07
Chloroform	2.9	1.36E-12	3.05E-07	4.52E-13	1.02E-07	5.07E-11	3.08E-06	---	---	---	---	---	5.25E-11	3.48E-06
cis-1,2-Dichloroethene	3.5	NA	3.63E-08	NA	1.21E-07	NA	4.90E-06	96	NA	NA	NA	1.07E-05	NA	1.58E-05
Dichlorodifluoromethane	3.6	NA	6.28E-08	NA	6.28E-09	NA	3.43E-06	---	---	---	---	---	NA	3.49E-06
Ethylbenzene	233	NA	2.44E-06	NA	8.23E-07	NA	5.23E-06	---	---	---	---	---	NA	8.50E-06
Methyl ethyl ketone (MEK)	12	NA	2.16E-08	NA	7.20E-09	NA	4.02E-08	---	---	---	---	---	NA	6.89E-08
Methyl isobutyl ketone	12	NA	1.63E-07	NA	5.42E-08	NA	2.22E-08	---	---	---	---	---	NA	2.39E-07
o-Xylene	600	NA	1.05E-06	NA	1.05E-07	NA	4.23E-06	---	---	---	---	---	NA	5.38E-06
Trichloroethene	29	9.68E-15	3.42E-10	1.94E-12	6.84E-08	3.37E-11	3.30E-06	240	3.36E-08	1.19E-03	4.48E-11	4.38E-06	3.37E-08	1.20E-03
Vinyl chloride	---	---	---	---	---	---	---	5.2	1.91E-08	5.87E-04	1.02E-11	8.32E-07	1.91E-08	5.88E-04
Xylenes, Total	90	NA	4.72E-07	NA	1.59E-07	NA	1.78E-05	---	---	---	---	---	NA	1.85E-05
Benzo(a)anthracene	66	3.13E-10	NA	2.41E-10	NA	4.24E-12	NA	---	---	---	---	---	5.58E-10	NA
Benzo(b)fluoranthene	48	2.26E-10	NA	1.74E-10	NA	2.33E-12	NA	---	---	---	---	---	4.02E-10	NA
Chrysene	274	1.29E-11	NA	9.96E-12	NA	2.43E-12	NA	---	---	---	---	---	2.53E-11	NA
Fluoranthene	84	NA	9.54E-07	NA	7.34E-07	NA	4.60E-08	---	---	---	---	---	NA	1.73E-06
Organics Total Risk		**5.53E-10**	**5.53E-06**	**4.27E-10**	**2.19E-06**	**9.34E-11**	**4.23E-05**		**5.28E-08**	**1.78E-03**	**5.50E-11**	**1.72E-05**	**5.39E-08**	**1.84E-03**
Aliphatics > nC6 to nC8 (TX1006)	---	---	---	---	---	---	---	110	NA	NA	NA	4.09E-06	NA	4.09E-06
Aliphatics > nC8 to nC10 (TX1006)	---	---	---	---	---	---	---	47	NA	NA	NA	5.09E-05	NA	5.09E-05
Aromatics > nC8 to nC10 (TX1006)	---	---	---	---	---	---	---	47	NA	NA	NA	2.00E-06	NA	2.00E-06
TPH-GRO	**45,807**	**NA**	**NA**	**NA**	**2.08E-04**	**NA**	**2.70E-04**	**203**	**NA**	**NA**	**NA**	**5.69E-05**	**NA**	**5.35E-04**
Aliphatics > nC10 to nC12 (TX1006)	---	---	---	---	---	---	---	1,497	NA	NA	NA	2.45E-03	NA	2.45E-03
Aliphatics > nC12 to nC16 (TX1006)	---	---	---	---	---	---	---	4,641	NA	NA	NA	3.29E-02	NA	3.29E-02
Aliphatics > nC16 to nC21 (TX1006)	---	---	---	---	---	---	---	1,497	NA	NA	NA	1.00E-01	NA	1.00E-01
Aromatics > nC10 to nC12 (TX1006)	---	---	---	---	---	---	---	1,497	NA	NA	NA	2.95E-05	NA	2.95E-05
Aromatics > nC12 to nC16 (TX1006)	---	---	---	---	---	---	---	1,946	NA	NA	NA	2.64E-05	NA	2.64E-05
Aromatics > nC16 to nC21 (TX1006)	---	---	---	---	---	---	---	1,497	NA	NA	NA	1.52E-05	NA	1.52E-05
TPH-DRO	**1,049,429**	**NA**	**2.31E-03**	**NA**	**7.04E-03**	**NA**	**2.01E-03**	**12,575**	**NA**	**NA**	**NA**	**1.36E-01**	**NA**	**1.47E-01**
Aliphatics > nC21 to nC35 (TX1006)	---	---	---	---	---	---	---	727	NA	NA	NA	4.86E-02	NA	4.86E-02
Aromatics > nC21 to nC35 (TX1006)	---	---	---	---	---	---	---	295	NA	NA	NA	1.62E-06	NA	1.62E-06
TPH-ORO	**—**	**#REF!**	**#REF!**	**#REF!**	**#REF!**	**#REF!**	**#REF!**	**1,022**	**NA**	**NA**	**NA**	**4.86E-02**	**NA**	**4.86E-02**
TPH Total Risk		**NA**	**#REF!**	**NA**	**#REF!**	**NA**	**#REF!**		**NA**	**NA**	**NA**	**1.84E-01**	**NA**	**1.96E-01**
Arsenic	5,817	1.30E-08	2.03E-03	4.54E-08	7.07E-03	5.50E-10	8.55E-06	81	NA	NA	NA	NA	5.90E-08	9.10E-03
Barium	---	---	---	---	---	---	---	2,574	NA	NA	NA	NA	NA	NA
Cadmium	425	NA	1.48E-06	NA	1.48E-04	1.68E-11	3.74E-07	669	NA	NA	NA	NA	1.68E-11	1.50E-04
Chromium	19,798	NA	NA	NA	NA	5.24E-09	NA	2,381	NA	NA	NA	NA	5.24E-09	NA
Chromium, hexavalent	---	---	---	---	---	---	---	16	NA	NA	NA	NA	NA	NA
Mercury	38	NA	4.44E-06	NA	4.46E-05	NA	1.28E-03	0.76	NA	NA	NA	8.21E-06	NA	1.34E-03
Selenium	329	NA	2.30E-06	NA	2.30E-05	NA	2.55E-06	---	---	---	---	---	NA	2.78E-05
Metals Total Risk		**1.30E-08**	**2.04E-03**	**4.54E-08**	**7.28E-03**	**5.81E-09**	**1.30E-03**		**NA**	**NA**	**NA**	**8.21E-06**	**6.43E-08**	**1.06E-02**
CUMULATIVE RISK		**1.36E-08**	**#REF!**	**4.58E-08**	**#REF!**	**5.90E-09**	**#REF!**		**5.28E-08**	**1.78E-03**	**5.50E-11**	**1.84E-01**	**1.18E-07**	**2.08E-01**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
GRO: Gasoline range organic
DRO: Diesel range organic
ORO: Oil range organic
ug/L: Micrograms per liter
ug/kg: Micrograms per kilogram

Table 7D-10(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Future Construction Worker
Sub-area 6D: GKN Facility, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc. (ug/L)	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ		IELCR	HQ	IELCR	HQ		
Dichlorodifluoromethane	5.5	NA	9.50E-08	NA	9.50E-09	NA	5.19E-06	---	---	---	---	---	NA	5.29E-06
Methyl ethyl ketone (MEK)	69	NA	1.19E-07	NA	3.98E-08	NA	2.22E-07	---	---	---	---	---	NA	3.81E-07
Tetrachloroethene	---	---	---	---	---	---	---	12	2.01E-07	2.60E-03	9.04E-12	3.97E-07	2.01E-07	2.60E-03
Toluene	27	NA	3.50E-08	NA	1.17E-07	NA	2.11E-07	---	---	---	---	---	NA	3.63E-07
Organics Total Risk		**NA**	**2.49E-07**	**NA**	**1.66E-07**	**NA**	**5.62E-06**		**2.01E-07**	**2.60E-03**	**9.04E-12**	**3.97E-07**	**2.01E-07**	**2.60E-03**
TPH-GRO	12,000	NA	NA	NA	4.91E-05	NA	5.09E-04	---	---	---	---	---	NA	5.58E-04
TPH-DRO	2,500	NA	1.65E-05	NA	1.51E-05	NA	3.45E-05	---	---	---	---	---	NA	6.62E-05
TPH-ORO	2,500	NA	1.91E-05	NA	1.47E-05	NA	3.72E-06	---	---	---	---	---	NA	3.76E-05
TPH Total Risk		**NA**	**3.56E-05**	**NA**	**7.89E-05**	**NA**	**5.47E-04**		**NA**	**NA**	**NA**	**NA**	**NA**	**6.62E-04**
Arsenic	9,250	2.07E-08	3.23E-03	7.22E-08	1.12E-02	8.74E-10	1.36E-05	8.9	NA	NA	NA	NA	9.38E-08	1.45E-02
Chromium	---	---	---	---	---	---	---	41	NA	NA	NA	NA	NA	NA
Metals Total Risk		**2.07E-08**	**3.23E-03**	**7.22E-08**	**1.12E-02**	**8.74E-10**	**1.36E-05**		**NA**	**NA**	**NA**	**NA**	**9.38E-08**	**1.45E-02**
CUMULATIVE RISK		**2.07E-08**	**3.26E-03**	**7.22E-08**	**1.13E-02**	**8.74E-10**	**5.66E-04**		**2.01E-07**	**2.60E-03**	**9.04E-12**	**3.97E-07**	**2.95E-07**	**1.77E-02**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
GRO: Gasoline range organic
DRO: Diesel range organic
ORO: Oil range organic
ug/L: Micrograms per liter

ug/kg: Micrograms per kilogram

Table 9A-11(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Future Construction Worker
Sub-area 8A: Office Complex North, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc. (ug/L)	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ		IELCR	HQ	IELCR	HQ		
Acetone	71	NA	7.45E-08	NA	2.60E-08	NA	4.44E-07	---	---	---	---	---	NA	5.45E-07
cis-1,2-Dichloroethene	38	NA	4.01E-07	NA	1.34E-06	NA	5.43E-05	---	---	---	---	---	NA	5.60E-05
Methyl ethyl ketone (MEK)	61	NA	1.07E-07	NA	3.56E-08	NA	1.99E-07	---	---	---	---	---	NA	3.41E-07
Methylene Chloride	7.3	8.13E-13	1.26E-07	2.71E-13	4.21E-08	3.25E-12	1.21E-06	---	---	---	---	---	4.34E-12	1.38E-06
Trichloroethene	34	1.13E-14	3.98E-10	2.25E-12	7.97E-08	3.92E-11	3.84E-06	110	1.55E-08	5.47E-04	4.23E-11	4.14E-06	1.56E-08	5.56E-04
Toluene	---	---	---	---	---	---	---	1.5	NA	3.82E-05	NA	3.72E-09	NA	3.82E-05
Vinyl chloride	---	---	---	---	---	---	---	1.9	7.04E-09	2.16E-04	7.67E-12	6.28E-07	7.05E-09	2.17E-04
Organics Total Risk		**8.24E-13**	**7.10E-07**	**2.53E-12**	**1.52E-06**	**4.25E-11**	**5.99E-05**		**2.25E-08**	**8.02E-04**	**5.00E-11**	**4.77E-06**	**2.26E-08**	**8.69E-04**
Arsenic	11,057	2.48E-08	3.86E-03	8.63E-08	1.34E-02	1.04E-09	1.63E-05	23	NA	NA	NA	NA	1.12E-07	1.73E-02
Barium	---	---	---	---	---	---	---	860	NA	NA	NA	NA	NA	NA
Chromium	---	---	---	---	---	---	---	110	NA	NA	NA	NA	NA	NA
Manganese	---	---	---	---	---	---	---	1,300	NA	NA	NA	NA	NA	NA
Mercury	43	NA	4.98E-06	NA	5.01E-05	NA	1.44E-03	---	---	---	---	---	NA	1.50E-03
Organics Total Risk		**2.48E-08**	**3.86E-03**	**8.63E-08**	**1.35E-02**	**1.04E-09**	**1.46E-03**		**NA**	**NA**	**NA**	**NA**	**1.12E-07**	**1.88E-02**
CUMULATIVE RISK		**2.48E-08**	**3.86E-03**	**8.63E-08**	**1.35E-02**	**1.09E-09**	**1.52E-03**		**2.25E-08**	**8.02E-04**	**5.00E-11**	**4.77E-06**	**1.35E-07**	**1.97E-02**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
DRO: Diesel range organic
GRO: Gasoline range organic
ORO: Oil range organic
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter

Table 9B-11(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Future Construction Worker
Sub-area 8B: Office Complex North, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc. (ug/L)	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ		IELCR	HQ	IELCR	HQ		
Methyl ethyl ketone (MEK)	11	NA	1.96E-08	NA	6.54E-09	NA	3.65E-08	---	---	---	---	---	NA	6.26E-08
Benzo(b)fluoranthene	66	3.12E-10	NA	2.40E-10	NA	3.22E-12	NA	---	---	---	---	---	5.55E-10	NA
Chrysene	44	2.08E-12	NA	1.60E-12	NA	3.91E-13	NA	---	---	---	---	---	4.07E-12	NA
Organics Total Risk		**3.14E-10**	**1.96E-08**	**2.42E-10**	**6.54E-09**	**3.61E-12**	**3.65E-08**		**NA**	**NA**	**NA**	**NA**	**5.59E-10**	**6.26E-08**
Aliphatics > nC6 to nC8 (TX1006)	---	---	---	---	---	---	---	8.33E+01	NA	NA	NA	3.13E-06	NA	3.13E-06
Aliphatics > nC8 to nC10 (TX1006)	---	---	---	---	---	---	---	8.33E+01	NA	NA	NA	9.19E-05	NA	9.19E-05
Aromatics > nC8 to nC10 (TX1006)	---	---	---	---	---	---	---	8.33E+01	NA	NA	NA	3.63E-06	NA	3.63E-06
TPH-GRO	---	---	---	---	---	---	---	**2.50E+02**	**NA**	**NA**	**NA**	**9.87E-05**	**NA**	**9.87E-05**
Aliphatics > nC10 to nC12 (TX1006)	---	---	---	---	---	---	---	3.40E+01	NA	NA	NA	5.62E-05	NA	5.62E-05
Aliphatics > nC12 to nC16 (TX1006)	---	---	---	---	---	---	---	7.60E-01	NA	NA	NA	5.44E-06	NA	5.44E-06
Aliphatics > nC16 to nC21 (TX1006)	---	---	---	---	---	---	---	2.50E-03	NA	NA	NA	1.69E-07	NA	1.69E-07
Aromatics > nC10 to nC12 (TX1006)	---	---	---	---	---	---	---	4.67E+02	NA	NA	NA	9.37E-06	NA	9.37E-06
Aromatics > nC12 to nC16 (TX1006)	---	---	---	---	---	---	---	3.74E+03	NA	NA	NA	5.25E-05	NA	5.25E-05
Aromatics > nC16 to nC21 (TX1006)	---	---	---	---	---	---	---	6.50E+02	NA	NA	NA	7.34E-06	NA	7.34E-06
TPH-DRO	---	---	---	---	---	---	---	**4.89E+03**	**NA**	**NA**	**NA**	**1.31E-04**	**NA**	**1.31E-04**
Aliphatics > nC21 to nC35 (TX1006)	---	---	---	---	---	---	---	2.50E-03	NA	NA	NA	1.69E-07	NA	1.69E-07
Aromatics > nC21 to nC35 (TX1006)	---	---	---	---	---	---	---	6.60E+00	NA	NA	NA	6.89E-08	NA	6.89E-08
TPH-ORO	---	---	---	---	---	---	---	**6.60E+00**	**NA**	**NA**	**NA**	**2.38E-07**	**NA**	**2.38E-07**
TPH Total Risk		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**		**NA**	**NA**	**NA**	**2.30E-04**	**NA**	**2.30E-04**
Arsenic	---	---	---	---	---	---	---	15	NA	NA	NA	NA	NA	NA
Chromium	---	---	---	---	---	---	---	51	NA	NA	NA	NA	NA	NA
Mercury	---	---	---	---	---	---	---	---	---	---	---	---	NA	NA
Organics Total Risk		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
CUMULATIVE RISK		**3.14E-10**	**1.96E-08**	**2.42E-10**	**6.54E-09**	**3.61E-12**	**3.65E-08**		**NA**	**NA**	**NA**	**2.30E-04**	**5.59E-10**	**2.30E-04**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
DRO: Diesel range organic
GRO: Gasoline range organic
ORO: Oil range organic
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter

Table 9C-11(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Future Construction Worker
Sub-area 8C: Office Complex North, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc. (ug/L)	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ		IELCR	HQ	IELCR	HQ		
Acetone	67	NA	7.01E-08	NA	2.44E-08	NA	4.18E-07	---	---	---	---	---	NA	5.12E-07
Tetrachloroethene	3.4	2.71E-12	3.50E-08	9.03E-12	1.17E-07	1.47E-11	6.48E-07	---	---	---	---	---	2.65E-11	7.99E-07
Organics Total Risk		**2.71E-12**	**1.05E-07**	**9.03E-12**	**1.41E-07**	**1.47E-11**	**1.07E-06**		**NA**	**NA**	**NA**	**NA**	**2.65E-11**	**1.31E-06**
TPH-GRO	2,096	NA	NA	NA	8.58E-06	NA	8.89E-05	650	NA	NA	NA	5.21E-04	NA	6.19E-04
TPH-DRO	390,375	NA	2.58E-03	NA	2.36E-03	NA	5.39E-03	250	NA	NA	NA	6.46E-03	NA	1.68E-02
TPH Total Risk		**NA**	**2.58E-03**	**NA**	**2.36E-03**	**NA**	**5.48E-03**		**NA**	**NA**	**NA**	**6.98E-03**	**NA**	**1.74E-02**
CUMULATIVE RISK		**2.71E-12**	**2.58E-03**	**9.03E-12**	**2.36E-03**	**1.47E-11**	**5.48E-03**		**NA**	**NA**	**NA**	**6.98E-03**	**2.65E-11**	**1.74E-02**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
TPH: Total petroleum hydrocarbon
GRO: Gasoline range organic
DRO: Diesel range organic
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter

Table 10-8(b)
Calculation of Individual Excess Lifetime Cancer Risk (IELCR) and Hazard Quotient (HQ) for a Future Construction Worker
Area 9: Gun Range, Boeing Tract 1, St. Louis, Missouri

COCs	Average Soil Conc.	Dermal Contact with Soil		Accidental Ingestion of Soil		Outdoor Inhalation of Vapors and Particulates from Soil		Average GW Conc. (ug/L)	Dermal Contact with Groundwater		Outdoor Inhalation of Vapors from Groundwater		Sum of IELCR	Sum of HQ (HI)
	(ug/kg)	IELCR	HQ	IELCR	HQ	IELCR	HQ		IELCR	HQ	IELCR	HQ		
Acetone	17	NA	1.73E-08	NA	6.01E-09	NA	1.03E-07	---	---	---	---	---	NA	1.26E-07
Methylene chloride	6.5	7.23E-13	1.12E-07	2.41E-13	3.75E-08	2.89E-12	1.07E-06	---	---	---	---	---	3.86E-12	1.22E-06
Naphthalene	110	NA	7.66E-07	NA	6.44E-07	NA	8.07E-08	---	---	---	---	---	NA	1.49E-06
Toluene	4.4	NA	5.75E-09	NA	1.92E-08	NA	3.48E-08	---	---	---	---	---	NA	5.97E-08
Organics Total Risk		**7.23E-13**	**9.02E-07**	**2.41E-13**	**7.06E-07**	**2.89E-12**	**1.29E-06**		**NA**	**NA**	**NA**	**NA**	**3.86E-12**	**2.90E-06**
TPH-GRO	500	NA	NA	NA	2.05E-06	NA	2.12E-05	500	NA	NA	NA	1.94E-04	NA	2.18E-04
TPH-DRO	2,520	NA	1.67E-05	NA	1.52E-05	NA	3.48E-05	121	NA	NA	NA	1.52E-03	NA	1.58E-03
TPH-ORO	3,148	NA	2.41E-05	NA	1.86E-05	NA	4.68E-06	311	NA	NA	NA	1.03E-02	NA	1.04E-02
TPH Total Risk		**NA**	**4.07E-05**	**NA**	**3.58E-05**	**NA**	**6.07E-05**		**NA**	**NA**	**NA**	**1.20E-02**	**NA**	**1.22E-02**
Arsenic	---	---	---	---	---	---	---	37	NA	NA	NA	NA	NA	NA
Cadmium	451	NA	1.57E-06	NA	1.57E-04	1.79E-11	3.97E-07	---	---	---	---	---	1.79E-11	1.59E-04
Copper	13,170	NA	1.15E-05	NA	1.15E-04	NA	2.03E-05	---	---	---	---	---	NA	1.47E-04
Manganese	611,550	NA	1.37E-04	NA	1.52E-03	NA	1.93E-02	1,750	NA	NA	NA	NA	NA	2.09E-02
Nickel	12,960	NA	1.13E-06	NA	2.26E-05	6.86E-11	1.00E-04	---	---	---	---	---	6.86E-11	1.24E-04
Selenium	2,412	NA	1.68E-05	NA	1.68E-04	NA	3.72E-04	---	---	---	---	---	NA	5.57E-04
Zinc	42,550	NA	4.95E-06	NA	4.95E-05	NA	6.25E-08	---	---	---	---	---	NA	5.45E-05
Metals Total Risk		**NA**	**1.73E-04**	**NA**	**2.04E-03**	**8.65E-11**	**1.98E-02**		**NA**	**NA**	**NA**	**NA**	**8.65E-11**	**2.20E-02**
CUMULATIVE RISK		**7.23E-13**	**2.15E-04**	**2.41E-13**	**2.07E-03**	**8.94E-11**	**1.98E-02**		**NA**	**NA**	**NA**	**1.20E-02**	**9.03E-11**	**3.41E-02**

Notes:
NA: Not available
---: Risk evaluation was not performed.
HI: Hazard index
ug/kg: Micrograms per kilogram
ug/L: Micrograms per liter
GRO: Gasoline range organic
DRO: Diesel range organic
ORO: Oil range organic
TPH: Total petroleum organic

APPENDIX
D

APPENDIX D
EVALUATION OF LIGHT NON-AQUEOUS PHASE LIQUID

The Boeing Company
P.O. Box 516
St Louis, MO 63166-0516
(314) 232-0232

107A-6580-JWH
February 2, 2011

Ms. Christine Kump-Mitchell, P.E.
Environmental Engineer, Permits Section
Missouri Department of Natural Resources
Hazardous Waste Program
7545 South Lindbergh
St Louis, MO 63125

BOEING

Re: Residual LNAPL at Boeing Tract I Facility

Dear Ms. Kump-Mitchell:

The attached report presents a comprehensive evaluation of the historic and current status of light non-aqueous phase liquid (LNAPL) at the Boeing Tract 1 site. As part of the closure process for underground storage tanks under the Remediation Unit, LNAPL has been recovered from several wells at four sites (R0002046, R0002477, R0002516, and R0002517) in Risk Areas 1 and 2 using vacuum trucks. Based on our evaluation, currently the residual/trace LNAPL is localized, not mobile, and not a source of on-going groundwater impacts. Therefore, in the Corrective Measures Study (CMS) we do not intend to present any remedial options to deal with the trace LNAPL. (The attached report or a variation will be included in the CMS.)

We request that you please review the attached report so we can reach some tentative agreement prior to the submission of the CMS. This is consistent with our mutual desire to work together to resolve certain issues upfront so the final CMS will be easier to review by the Agencies.

If you have any questions, please call me or our consultants Atul Salhotra or Kendall Pickett at 713-784-5151.

Sincerely,

Joe Haake
Environmental Scientist
(314) 777-9181

cc: Joletta Golik, City of STL Airport Authority
Rich Nussbaum, MoDNR
Atul Salhotra, RAM Group
Bruce Stuart, MoDNR
Amber Whisnant, US EPA Region 7

EVALUATION OF LIGHT NON AQUEOUS PHASE LIQUID
Boeing Tract 1 Facility, Hazelwood Missouri

1.0 OBJECTIVE

Light non-aqueous phase liquid (LNAPL) removal, gauging data, and the concentrations at wells with LNAPL were evaluated to determine whether:

- LNAPL is an ongoing source for groundwater impacts, and
- If there is a need to continue further remediation of LNAPL.

2.0 DATA EVALUATION

Figure 1 shows the location of wells with current and historic detection of LNAPL. Table 1 presents all the available data related to LNAPL measurements and Table 2 presents the gauging data for the wells that had LNAPL since 2008. LNAPL has never been observed in Risk Areas 4, 5, 7, 8, and 9.

The petroleum products used in Risk Area 1 and 2 were jet fuels and gasoline which contain paraffins (primarily, C6-C16) and aromatic compounds. Paraffins are typically not considered chemicals of concern (COCs) since their degradation rates are high and the human health risk for these compounds is low and were not included in the sampling and analysis plan. Several aromatic constituents were measured as a part of the various ground water monitoring events.

2.1 Risk Area 1 (Runway Protection Zone)

Historically sixteen wells in Area 1 had LNAPL but only five wells have indicated LNAPL since 2008 (Table 2). Of the sixteen wells, five wells have not been gauged since 2008 and MW-A2 and MW-A21 are missing or have been demolished. The five wells that were not gauged are expected to have a similar LNAPL thickness compared to the wells that were gauged as all these wells are in the same area. The maximum LNAPL thickness observed in Area 1 since 2008 is 0.01 ft. During October/November 2010 groundwater monitoring event, none of these wells had a measurable thickness, although a sheen was observed in four wells.

Groundwater samples were collected from below the LNAPL from five wells to determine whether the trace LNAPL was a continuing source of the COCs. Specifically, samples were collected at MW-A1 and MW-A3 during November 2008 event, MW-A27 during April-May 2010 event, and from MW-A1, MW-A3, and MW-A25 during October-November 2010 event. The concentration data presented in Table 3 shows six petroleum based aromatics and TPH that were detected. Comparison of the detected concentrations with the corresponding groundwater screening values indicates that all concentrations were below the screening value. Note the screening levels used are the MCLs or equivalent, although the groundwater consumption pathway is not complete. Regarding MW-A27, LNAPL of 0.01 ft thickness was observed during gauging of April-May 2010 event, but was not observed during sampling two weeks later. The groundwater sample collected from MW-A27 did not contain any detectable hydrocarbons.

Attachments 1 and 2 are the underground storage tank (UST) closure letters for sites #3 and #4 located in Area 1. BTEX compounds generally present in gasoline were not detected in the groundwater. Since all the detected petroleum based aromatics concentrations are below the screening values, LNAPL is not a source for groundwater contamination in Area 1. Further, since only sheen was observed in Area 1 during the latest event, only residual LNAPL remains in Area 1 and no further active remediation is necessary. In time, due to natural attenuation processes, it is expected that the trace residual LNAPL will continue to degrade.

2.2 Risk Area 2 (Demolished Area)

Historically, fourteen wells in Area 2 had LNAPL of which eight wells have had LNAPL since 2008 (Table 2). Of the fourteen wells, one well was not gauged since 2008 and four wells are missing or were demolished. The maximum LNAPL thickness observed in Area 2 since 2008 is 0.05 ft. During the October-November 2010 monitoring event, only MW-9S and MW-10S had LNAPL with thicknesses of 0.01 and 0.03 ft, respectively. MW-9S and MW-10S are located in Area 2B within 50 ft from one another. None of the other wells in the area had LNAPL including MW-11S located 100 ft east (down gradient) of MW-10S. Therefore, the LNAPL is localized in a small area around MW-9S and MW-10S.

During November 2008, five wells had LNAPL and groundwater samples were collected from each of these wells. Sheen was observed at MW-A6 and MW-5I during gauging in April-May 2010 and was not observed during sampling two weeks later. The concentration data for detected chemicals is presented in Table 4. Specifically, the detected benzene, xylene, and MTBE concentrations were below the respective screening values. TPH-DRO concentration at MW-9S and naphthalene concentration at TP-4 exceeded the respective screening value during November 2008 event. These exceedances appear to be localized at the two wells since none of the other wells in Area 2 had exceedances for TPH-DRO and naphthalene. The average TPH-DRO concentration at MW-9S from the data collected until 2004 was 4,525 µg/L and the concentration of 720,000 µg/L appear to be an anomaly. Therefore, MW-9S will be re-sampled in March. The average concentration of naphthalene at TP-4 until 2004 was 5.09 µg/L and the concentration is decreasing and is localized to this well. PCE and TCE and their degradation products detected in this area are chlorinated solvents, hence LNAPL is not the source for these chemicals.

Therefore, the tracc/residual LNAPL is not acting as a source of groundwater impact in Area 2. Also the LNAPL thickness is very small and the thickness fluctuates. Therefore, there is no need for any further remediation to address LNAPL in Area 2. Attachments 3 and 4 are the UST closure letters for sites #1 and #2 located in Area 2.

2.3 Risk Area 3 (Retained Area)

LNAPL was not observed at any well in Area 3 except MW-A4 during the April-May 2010 event. Sheen was observed at MW-A4 during gauging in April-May 2010, but it was not present during sampling two weeks later. No VOCs were detected at MW-A4. Therefore, LNAPL is not of concern in this area.

2.4 Risk Area 6 (GKN Facility)

Sheen was observed at RC2 in July, 2004. None of the other wells in this area had LNAPL. Therefore LNAPL is not of concern in this area.

3.0 CONCLUSIONS

Based on the above, LNAPL is not contributing to the groundwater impacts in any of the areas and; therefore no further remedial action is necessary to address LNAPL issues at the site.

Table 1
LNAPL Summary (1992-2010)
Boeing Tract 1, Hazelwood, Missouri

Well ID	Installation Date	LNAPL		Last Gauging Data	Last Date of LNAPL Observance	Last Observed LNAPL Thickness (ft)
		at Well Installation	Since 92			
Area 1 (Runway Protection Zone)						
MW-A1	7/12/1989	Yes	Yes	11/3/2010	11/3/2010	Sheen
MW-A2	7/12/1989	Sheen	No	--	--	--
MW-A3	7/13/1989	Yes	Yes	11/3/2010	11/3/2010	Sheen
MW-A5	7/18/1989	Yes	No	--	--	--
MW-A14	8/3/1989	Yes	No	--	--	--
MW-A15	8/3/1989	Yes	No	--	--	--
MW-A18	8/4/1989	Sheen	No	--	--	--
MW-A21	8/8/1989	Sheen	No	--	--	--
MW-A22	10/30/1989	Yes	No	--	--	--
MW-A23	10/30/1989	Yes	No	--	--	--
MW-A25	11/1/1989	No	Yes	11/3/2010	11/3/2010	Sheen
MW-A26	11/1/1989	No	Yes	11/3/2010	11/3/2010	Sheen
MW-A27	11/1/1989	No	Yes	11/3/2010	4/13/2010	0.01
MW-A28	11/1/1989	Yes	No	--	--	--
B45CMW-3A	1995	Yes	Yes	3/1/2004	3/1/2004	Sheen
B45CMW-3B	1995	Yes	Yes	11/18/1998	11/18/1998	Sheen
Area 2 (Demolished Area)						
MW-A6	7/14/1989	No	Yes	10/29/2010	4/13/2010	Sheen
MW-A9	7/17/1989	Yes	No data	--	--	--
MW-A10	7/18/1989	No	Yes	3/31/1997	12/26/1996	Sheen
MW-A11	7/19/1989	Yes	Yes	--	--	--
MW-A12	8/2/1989	Yes	Yes	12/26/1996	1/14/1990	1.13
MW-A13	8/2/1989	Yes	Yes	11/1/2010	11/18/2008	Sheen
MW-A19	8/7/1989	Yes	No	12/27/1994	2/1/1990	Sheen
MW-A20	8/7/1989	No	Yes	NA	NA	NA
MW-5I	4/21/1998	No	Yes	11/1/2010	4/13/2010	Sheen
MW-9S	12/20/2000	Yes	Yes	11/1/2010	11/1/2010	0.1
MW-10S	12/12/2000	Yes	Yes	10/29/2010	10/29/2010	0.03
TP-3	2/5/1998	No	Yes	11/1/2010	11/18/2008	0.01
TP-4	2/6/1998	No	Yes	11/1/2010	11/18/2008	0.01
TP-6	9/5/2001	Yes	Yes	10/29/2010	4/13/2010	Sheen
Area 3 (Retained Area)						
MW-A4	7/13/1989	No	Yes	10/28/2010	4/13/2010	Sheen

Notes

Sheen observed only on 07/25/2004 at RC2 (Area 6B). None of the other wells in Area 6 had LNAPL

LNAPL not observed in Areas 4,5,7,8,9

NA: Information not available

--: LNAPL was observed only at installation

Table 2
LNAPL Summary (Since 2008)
Boeing Tract 1, Hazelwood, Missouri

Well ID	Area / Sub-Area	November-2008			April-2010#			October-November 2010		
		Date	LNAPL Thickness (ft)	Depth to Water (ft btoc)	Date	LNAPL Thickness (ft)	Depth to Water (ft btoc)	Date	LNAPL Thickness (ft)	Depth to Water (ft btoc)
MW-A1	1	11/18/2008	0.01	4.84	4/13/2010	Sheen	4.88	11/3/2010	Sheen	5.26
MW-A3	1	11/18/2008	0.01	3.87	4/13/2010	0.01	4.06	11/3/2010	Sheen	4.28
MW-A25	1	NA	NA	NA	NA	NA	NA	11/3/2010	Sheen	4.36
MW-A26	1	NA	NA	NA	NA	NA	NA	11/3/2010	Sheen	6.21
MW-A27	1	NA	NA	NA	4/13/2010	0.01	3.63	NA	NA	NA
MW-A6*	2A	NA	NA	NA	4/13/2010	Sheen	4.83	NA	NA	NA
MW-9S	2B	11/18/2008	0.01	6.47	4/13/2010	0.01	4.05	11/1/2010	0.1	4.12
MW-10S	2B	11/18/2008	0.05	6.40	4/13/2010	0.01	6.11	10/29/2010	0.03	6.03
MW-5I	2B	NA	NA	NA	4/13/2010	Sheen	6.84	NA	NA	NA
TP-3	2B	11/18/2008	0.01	5.47	NA	NA	NA	NA	NA	NA
TP-4	2B	11/18/2008	0.01	3.88	NA	NA	NA	NA	NA	NA
TP-6	2B	NA	NA	NA	4/13/2010	Sheen	4.85	NA	NA	NA
MW-A13	2C	11/18/2008	Sheen	4.83	NA	NA	NA	NA	NA	NA
MW-A4	3C	NA	NA	NA	4/13/2010	Sheen	9.40	NA	NA	NA

Notes
NA: LNAPL not observed
*: Previously labeled as MW-A16
#: MW-A27, MW-A6, MW-5I, and MW-A4 had LNAPL or sheen during gauging and did not have any LNAPL during sampling two weeks later
ft: feet
btoc: below top of casing

Table 3

Groundwater Concentrations of Petroleum Related Chemicals (Detected Only) at Wells with LNAPL in Area 2

Boeing Tract 1, Hazelwood, Missouri

Sample	Screening Value*	MW-A1	MW-A3	MW-A1	MW-A3
Date Collected	(µg/L)	11/19/2008		11/4/2010	
TPH (8260/8270)					
TPH - GRO (C6 - C10) (8260)	18,100	230 J		NA	NA
TPH-DRO (C10 - C21)	34,300	2,780	2,790	NA	NA
TPH-ORO (C21 - C35)	31,800	556	493	NA	NA
VOCs (8260)					
1,2,3-Trimethylbenzene	--	6.42			
Isopropylbenzene	680	4.5 J	3.3 J	4.3 J	4.3 J
n-Butylbenzene	98.9	3 J	1.2 J	6.1	3.8 J
n-Propylbenzene	1,300	4.9 J	3.7 J	6.3	2.1 J
sec-Butylbenzene	106	4.1 J	2.1 J	4.8 J	3.6 J
tert-Butylbenzene	103	1 J	1 J	1.2 J	1.2 J

Notes:

NA: Not analyzed

J: analyte detected below reporting limit

Chemicals detected at least once are shown

--: Screening value not available

*: Screening values are MCLs or equivalent

Only petroleum based aromatic compounds are considered in this evaluation

No petroleum based aromatic compounds were detected at MW-A25

MW-A27 was sampled during April-May 2010 event and all the chemical concentrations were below detection limits

Table 4

Groundwater Concentrations of Petroleum Related Chemicals (Detected Only) at Wells with LNAPL in Area 2

Boeing Tract 1, Hazelwood, Missouri

Sample	Screening Value* (µg/L)	MW-9S	MW-10S	TP-3	TP-4	MW-A13
Date Collected		11/20/2008	11/19/2008	11/19/2008	11/19/2008	11/19/2008
Area ID		2B	2B	2B	2B	2C
TPH (8260/8270)						
TPH - GRO (C6 - C10) (8260)	18,100				645	
TPH-DRO (C10 - C21)	34,300	**762,000**	1,030	1,450 S	280 J	1,110
TPH-ORO (C21 - C35)	31,800		424	535	210 J	460 J
VOCs (8260)						
Benzene	5	1.9 J				
Isopropylbenzene	680			4.6 J		
Methyl tert-butyl ether	12				1 J	
Naphthalene	0.14				**2.4** J	
n-Butylbenzene	98.9			7.63		
n-Propylbenzene	1,300			3.3 J		
o-Xylene	1200	1.2 J				
sec-Butylbenzene	106			4.9 J		
Xylenes, Total	10,000	1.2 J				

Notes:

J: analyte detected below reporting limit

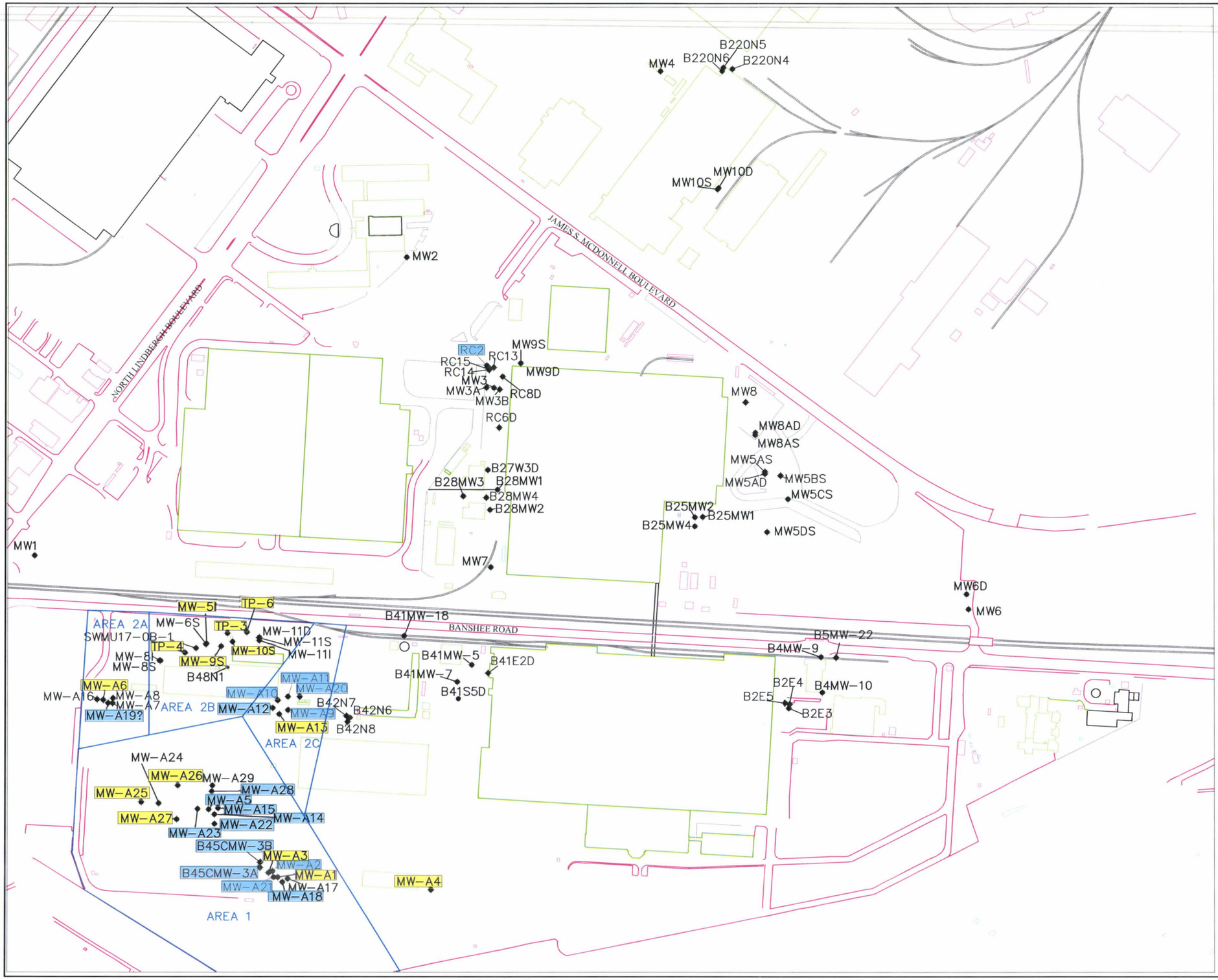
Concentrations shown in bold exceed the screening value

Chemicals detected atleast once are shown

*: Screening values are MCLs or equivalent

Only petroleum aromatic compounds are considered in this evaluation

MW-A27 was sampled during April-May 2010 event and all the petroleum based chemical concentrations were below detection limits



RAM Group of Gannett Fleming, Inc.
5433 Westheimer, Suite 725, Houston, TX

Figure 1
Location of Monitoring Wells
(Wells with LNAPL)
Boeing Tract 1
Hazelwood, Missouri

November 2010/BR | RAM Group (049992)

STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL QUALITY
P.O. Box 176 Jefferson City, MO 65102-0176

Mr. Elmer Dwyer
The Boeing Company
P.O. Box 516 MC S111-1099
St. Louis, MO 63166-0516

RE: Site #3, Tract 1, Building 45, Lindbergh Blvd., Dept. C, St. Louis, St. Louis County, MO
ST5700283, R0002516

Dear Mr. Dwyer:

The Missouri Department of Natural Resources' Hazardous Waste Program, Tanks Section, has received and reviewed a response letter dated January 28, 2002, submitted by The Boeing Company, for the above referenced site.

The laboratory analytical results of the groundwater samples collected from monitoring MW#A1, MW#A3, and MW#3A indicate the presence of petroleum hydrocarbon contamination at concentrations below the department's cleanup levels.

Therefore, based on a review of the analytical data and other information submitted, the department finds that no additional investigation or remedial action is currently required with regard to petroleum hydrocarbon spill/release. However, the department's finding is based solely on the information contained in these reports, and this finding does not constitute a certification or guarantee of the quality of the remedial action conducted or with regard to the lack of contamination on the property.

In the event a future petroleum hydrocarbon related environmental problem arises in the vicinity of this property, the department expressly reserves the right to require responsible parties to conduct additional investigation and/or remedial actions.

The monitoring wells must be properly closed and abandoned in accordance with the department's regulations. You may contact the department's Geological Survey and Resource Assessment Division for information regarding proper well closure.

Please direct questions regarding the Petroleum Storage Tank Insurance Fund to the Fund Administrator at (573) 761-4060 or (800) 765-2765.

If you have any questions regarding this letter, you may contact the project manager for this site, Mr. Matt Alhalabi of my staff at (573) 751-6822.

Sincerely,

HAZARDOUS WASTE PROGRAM

Frederick J. Hutson, R.G., Chief
Remediation Unit

FJH:mak

c: Mr. Neil Elfrink, Geological Survey and Resource Assessment Division
Mr. David Pate, Petroleum Storage Tank Insurance Fund
Mr. Mike Struckhoff, St. Louis Regional Office

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL QUALITY
P.O. Box 176 Jefferson City, MO 65102-0176

Mr. Joseph Haake
Environmental and Hazardous Materials Services
The Boeing Company
Dept. 464C, Building 220
Mailcode S221-1400
P.O. Box 516
St. Louis, MO 63166

RE: McDonnell Douglas Site #4, Banshee Rd., Bldg. 45, St. Louis, St. Louis County, MO
ST5700085, R0002477

Dear Mr. Haake:

The Missouri Department of Natural Resources' Hazardous Waste Program, Tanks Section, received and reviewed a groundwater monitoring report dated May 10, 2002, submitted by The Boeing Company, for the above referenced site.

The report documents the laboratory results of the groundwater samples collected during April 2002. The laboratory results indicate petroleum hydrocarbon contamination is below the department's cleanup levels.

Based on a review of the analytical data and other information submitted, the department finds that no additional investigation or remedial action is currently required with regard to petroleum hydrocarbon spill/release. However, the department's finding is based solely on the information contained in these reports, and this finding does not constitute a certification or guarantee of the quality of the remedial action conducted or with regard to the lack of contamination on the property.

In the event a future petroleum hydrocarbon related environmental problem arises in the vicinity of this property, the department expressly reserves the right to require responsible parties to conduct additional investigation and/or remedial actions.

Please direct questions regarding the Petroleum Storage Tank Insurance Fund to the Fund Administrator at (573) 761-4060 or (800) 765-2765.

If you have any questions, please contact the project manager for this site, Mr. Matt Alhalabi at (573) 751-6822.

Sincerely,

HAZARDOUS WASTE PROGRAM

Frederick J. Hutson, R.G., Chief
Remediation Unit

FJH:maj

c: Mr. David Pate, Petroleum Storage Tank Insurance Fund
Mr. Mike Struckhoff, St. Louis Regional Office

STATE OF MISSOURI
Mel Carnahan, Governor • Stephen M. Mahfood, Director
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL QUALITY
P.O. Box 176 Jefferson City, MO 65102-0176

February 23, 1999

Mr. Elmer Dwyer
Boeing Company
P.O. Box 516 MC S111-1099
St. Louis, MO 63166-0516

RE: McDonnell Douglas Site #1, Lambert Building #45-K, Bridgeton, MO - R0002517

Dear Mr. Dwyer:

The Tanks Section of the Hazardous Waste Program has received and reviewed the January 12, 1999, Soil Investigation Report for the site listed above.

Based upon a review of the analytical data and other information submitted, the department finds that no additional investigation or remedial action is currently required with regard to these petroleum substances. However, the department's finding is based solely on the information contained in these reports, and this finding does not constitute a certification or guarantee of the quality of the remedial action conducted or with regard to the lack of contamination on the property.

In the event a future petroleum-related environmental problem arises in the vicinity of this property, the department reserves the right to require responsible parties to conduct additional investigation and/or remedial actions.

If you have any questions regarding this letter, you may contact Ms. Julie Pearson of my staff at (573) 751-6822.

Sincerely,

HAZARDOUS WASTE PROGRAM

Jim Growney, Chief
Remediation Unit

JG:jpe

c: Mr. David Pate, Williams and Company
St. Louis Regional Office

STATE OF MISSOURI Bob Holden, Governor • Stephen M. Mahfood, Director
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL QUALITY
P.O. Box 176 Jefferson City, MO 65102-0176

Mr. Joseph Haake
Environmental and Hazardous Materials Services
The Boeing Company
Dept. 464C, Building 220
Mailcode S221-1400
P.O. Box 516
St. Louis, MO 63166

RE: McDonnell Aircraft, Tract II, Site No. 2, 4610 N. Lindbergh, Dept. 64C, St. Louis, St. Louis County, MO - ST0005887, R0002046

Dear Mr. Haake:

The Missouri Department of Natural Resources' Hazardous Waste Program, Tanks Section, has received and reviewed a groundwater monitoring report dated May 10, 2002, submitted by The Boeing Company, for the above referenced site.

The report documents the laboratory results of the groundwater samples collected during April 2002. The laboratory results indicate petroleum hydrocarbon contamination is below the department's cleanup levels.

Based on a review of the analytical data and other information submitted, the department finds that no additional investigation or remedial action is currently required with regard to petroleum hydrocarbon spill/release. However, the department's finding is based solely on the information contained in these reports, and this finding does not constitute a certification or guarantee of the quality of the remedial action conducted or with regard to the lack of contamination on the property.

In the event a future petroleum hydrocarbon related environmental problem arises in the vicinity of this property, the department expressly reserves the right to require responsible parties to conduct additional investigation and/or remedial actions.

Please direct questions regarding the Petroleum Storage Tank Insurance Fund to the Fund Administrator at (573) 761-4060 or (800) 765-2765.

If you have any questions, please contact the project manager for this site, Mr. Matt Alhalabi at (573) 751-6822.

Sincerely,

HAZARDOUS WASTE PROGRAM

Frederick J. Hutson, R.G., Chief
Remediation Unit

FJH:maj

c: Mr. David Pate, Petroleum Storage Tank Insurance Fund
Mr. Mike Struckhoff, St. Louis Regional Office

APPENDIX E
CHEMICALS IN GROUNDWATER EXCEEDING SCREENING VALUES

Transmitted by E-Mail

To: Christine Kump Mitchell, P.E.

From: Atul M. Salhotra, Ph.D.
Sungmi Moon, Ph.D.
Kendall Pickett

Cc: Joe Haake (Boeing)

Date: February 26, 2010

RE: Chemicals in Groundwater Exceeding Screening Values
Boeing Tract 1, St. Louis, Missouri

As one of action items discussed during the meeting between MDNR and Boeing Company on January 14, 2010, the latest groundwater analytical results collected in November 2008 were compared with groundwater screening values for ingestion and domestic use pathway. Note that the groundwater will not be used for domestic consumption at the site, nor within three miles of the site. As per the addendum to the *Risk-Based Corrective Action Report* (RAM Group, September 2004), the shallow, deep, and bedrock groundwater zones are not a probable source of future water supply, based on alternative sources and planned alternative use limitations. Hence, these screening values are not applicable for the site.

As per MDNR's recommendation in the draft comments on corrective measures study work plan received on January 12, 2010, the groundwater screening values were obtained using the following hierarchy:

- Maximum contaminant levels (MCLs),
- Regional screening levels (RSLs), and
- Missouri risk-based corrective action (MRBCA) default target levels (DTLs).

Table 1 presents the groundwater screening values and the groundwater analytical results collected in November 2008 for the chemicals detected at least once. Figure showing the location of groundwater samples is attached. Table 2(a) summarizes the chemicals for which the detected concentrations exceeded the screening values. Table 2(b) summarizes the chemicals that were not detected and the half the detection limits exceeded the screening values.

These tables indicate that the following chemicals exceed the screening values:

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Detected Chemicals

Metals (3):	Arsenic, chromium (hexavalent), and manganese
SVOCs (1):	Bis(2-ethylhexyl)phthalate
VOCs (10):	Benzene, 1,1-dichloroethane, 1,1-dichloroethylene, cis-1,2-dichloroethylene, trans-1,2,-dichloroethylene, naphthalene, tetrachloroethylene, 1,1,2-trichloroethane, trichloroethylene, and vinyl chloride
TPHs (3):	TPH-GRO, TPH-DRO, and TPH-ORO

Not Detected Chemicals

Metals (2):	Arsenic and chromium (hexavalent)
SVOCs (1):	Bis(2-ethylhexyl)phthalate
VOCs (14):	Benzene, n-butylbenzene, sec-butylbenzene, tert-butylbenzene, 1,1-dichloroethane, 1,1-dichloroethylene, trans-1,2-dichloroethylene, naphthalene, tetrachloroethylene, 1,2,4-trimethylbenzene, MTBE, methylene chloride, tert-butyl alcohol, and tetrahydrofuran

Further evaluation of data for the above chemicals indicates:

- **Arsenic**
  - All the detected concentrations (31 samples) and half the detection limits for the all the not-detected concentrations (13 samples) exceeded the screening value of 10 ug/L.
  - The concentrations observed at the site are most likely the background concentration in groundwater for the following reasons:
    - The exceedences are wide-spread at the site with no clear pattern, i.e., absence of high concentrations near a source.
    - Arsenic concentrations in wells that have not been impacted with other organic chemicals showed detected concentrations. For example, MW-4 in Sub-area 8B with not detected concentrations of organic chemicals had arsenic concentration of 34.9 ug/L in July 2000 and MWA1 located near hush house in Area 1 had arsenic concentrations of 44 ug/L in May 2001 and 51 ug/L in July 2001.
  - Therefore, arsenic in groundwater is not of concern.

- **Chromium (hexavalent)**
  - Total of five samples were collected from wells in Sub-area 6C.
  - Of the five samples, three samples had detected concentrations (4 ug/L, 5 ug/L, and 7 ug/L) exceeding the screening value of 0.043 ug/L. Half the detection limits of two non-detected samples also exceeded the screening value.

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- There is some evidence of chromium source at Sub-area 6C.
- ***Based on these, chromium (hexavalent) in Sub-area 6C will be further evaluated for plume stability.***

- **Manganese**

  - All the 14 samples analyzed had detected concentrations. Of these samples, 10 samples exceeded the screening value of 880 ug/L.
  - The detected concentrations ranged from 127 ug/L to 7,290 ug/L with the following distribution:
    - Below 880 ug/L 4 samples
    - > 880 ug/L – 2,500 ug/L 7 samples
    - > 2,500 ug/L – 5,000 ug/L 2 samples
    - > 5,000 ug/L 1 sample
  - Due to the wide range of concentration distribution, concentrations observed may not be background concentration.
  - ***Therefore, manganese in groundwater will be further evaluated for plume stability in Sub-areas 3D, 3H, 6B, and 8A.*** However, the source of manganese has not been identified and presumably manganese may have been analyzed for a natural attenuation parameter.

- **Bis(2-ethylhexyl)phthalate**

  - Total of eight samples were collected. Of these, only one sample (RC15 in Sub-area 6B) showed detected concentration of 18 ug/L which is greater than the screening value of 4.8 ug/L.
  - Half the detection limit (5 ug/L) for two not-detected samples exceeded the screening value slightly.
  - It is known that this is a common laboratory contaminant.
  - Based on these, bis(2-ethylhexyl)phthalate is not of concern.

- **1,1,2-Trichloroethane**

  - Total of 50 samples were collected. Of these, two samples showed detected concentrations. Only one sample (MW-5I in Sub-area 2B) showed detected concentration of 140 ug/L greater than the screening value of 5 ug/L.
  - Half the detection limits of all the not-detected samples were below the screening value. Therefore, the detection limits were appropriate.
  - ***Based on these, 1,1,2-trichloroethane in Sub-area 2B will be further evaluated for plume stability.***

- **1,1-Dichloroethane**

  - Total of 50 samples were collected. Of these, five samples showed detected concentrations.
  - Three samples below had detected concentrations greater than the screening

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value of 2.4 ug/L.

Sub-area	Sample ID	Concentration (ug/L)	
		November 2008	June 2003
3D	B41MW-5	13.8	104
6B	RC15	15.8	<1.0*
8A	MW10S	3.5	13.7

*: Concentration in April 2006

- The concentrations in B41MW-5 and MW-10S are lower than the concentrations during the previous sampling event in June 2003 as shown above. It is expected that these concentrations will continue to decrease.
- The concentration in RC15 increased from the previous concentration collected in April 2006. For the not detected concentrations, half the detection limit of 45 samples exceeded the screening value. However, all of the half the detection limits except for one sample (MW-5I) were 2.5 ug/L which is very close to the screening value. Therefore, these exceedences are not of concern. Half the detection limit in MW-5I was 0.5 ug/L during the previous sampling event in June 2003. Therefore, half the detection in MW-5I is not of concern.
- ***Based on these, 1,1-dichloroethane in Sub-area 6B will be further evaluated for plume stability.***

- **1,1-Dichloroethylene**

  - Total of 50 samples were collected. Of these, two samples showed detected concentrations.
  - One sample (MW3 in Sub-area 6B) had detected concentration of 25.1 ug/L greater than the screening value of 7 ug/L.
  - During the previous sampling event in June 2003, 1,1-dichloroethylene in MW3 was detected at 12 ug/L greater than the screening level of 7 ug/L.
  - Only one of not-detected samples (MW-5I in Sub-area 2B) had half the detection limits greater than the screening level.
  - During the previous sampling event in June 2003, 1,1-dichloroethylene in MW-5I was detected at 33 ug/L greater than the screening level of 7 ug/L.
  - 1,1-Dichloroethylene is a daughter product of TCE biodegradation.
  - ***Based on these, 1,1-dichloroethylene in Sub-area 2B and 6B will be further evaluated for plume stability.***

- **Benzene**

  - Total of 50 samples were collected. Of these, six samples showed detected concentrations and only one sample (B28MW4 in Sub-area 6B) of 109 ug/L which is greater than the screening value of 5 ug/L.
  - Half the detection limit (50 ug/L) of one sample (MW-5I) in Sub-area 2B exceeded the screening value. However, benzene in MW-5I was not-detected at the detection limit of 1 ug/L during the previous sampling event in June 2003. Therefore, benzene in MW-5I is not of concern.
  - ***Based on these, benzene in Sub-area 6B will be further evaluated for plume***

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stability.

- **cis-1,2-Dichloroethylene**

  - Total of 50 samples were collected. Of these, 14 samples showed detected concentrations.
  - Five samples below had detected concentrations greater than the screening value of 70 ug/L.

Sub-area	Sample ID	Concentration (ug/L)	
		November 2008	June 2003
2B	MW-5I	4,430	3,500
	TP-4	77.5	190
6B	B27W3D	448	950
	MW3	16,600	4,100
	RC15	210	6.5*

*: Concentration in April 2006

  - During the previous sampling event in June 2003, concentrations in above wells exceeded the screening value, except in RC15 in April 2006.
  - These wells are located in the trichloroethylene (TCE) source areas.
  - Half the detection limit (125 ug/L) of only one sample (MW-5I) in Sub-area 2B exceeded the screening value.
  - cis-1,2-Dichloroethylene is a daughter product of TCE biodegradation.
  - ***Based on these, cis-1,2-dichloroethylene in Sub-areas 2B and 6B will be further evaluated for plume stability.***

- **Naphthalene**

  - Total of 50 samples were collected. Of these, only one sample (TP-4 in Sub-area 2B) showed detected concentrations of 2.4 ug/L which is greater than the screening value of 0.14 ug/L.
  - All of the not-detected samples (49 samples) had half the detection limit (5 ug/L in 48 samples and 125 ug/L in one sample (MW-5I in Sub-area 2B)) exceeding the screening value. The detection limit of 10 ug/L could be practical quantitation limit due to analytical limitations.
  - Sub-area 2B was impacted with mainly chlorinated solvents.
  - Based on these, naphthalene is not of concern.

- **Tetrachloroethylene (PCE)**

  - Total of 50 samples were collected. Of these, six samples showed detected concentrations.
  - Three samples below had detected concentrations greater than the screening value of 5 ug/L.

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Sub-area	Sample ID	Concentration (ug/L)	
		November 2008	June 2003
2B	TP-4	111	2,700
6B	B28MW4	7.41	6.4
6C	MW6	6.2	12

- During the previous sampling event in June 2003, concentrations in above wells exceeded the screening value.
- Half the detection limit (125 ug/L) of only one sample (MW-5I) in Sub-area 2B exceeded the screening value. PCE concentration was 72 ug/L in MW-5I during the previous sampling event in June 2003.
- ***Based on these, PCE in Sub-areas 2B, 6B, and 6C will be further evaluated for plume stability.***

- **trans-1,2-Dichloroethylene**

  - Total of 50 samples were collected. Of these, seven samples showed detected concentrations.
  - Two samples below had detected concentrations greater than the screening value of 100 ug/L.

Sub-area	Sample ID	Concentration (ug/L)	
		November 2008	June 2003
6B	B28MW4	186	380
	MW3	190	68

  - During the previous sampling event in June 2003, concentration in B28MW4 exceeded the screening value.
  - These wells are located in the TCE source areas.
  - Half the detection limit (125 ug/L) of only one sample (MW-5I) in Sub-area 2B exceeded the screening value. However, trans-1,2-dichloroethylene concentration of 18 ug/L was detected from MW-5I during the previous sampling event in June 2003. Since TCE concentration in MW-5I (89,000 ug/L) is significantly higher than the screening value of 5 ug/L, it is likely that trans-1,2-dichloroethylene concentrations would increase due to TCE biodegradation.
  - trans-1,2-Dichlorethylene is a daughter product of TCE biodegradation.
  - ***Based on these, trans-1,2-dichloroethylene in Sub-areas 2B and 6B will be further evaluated for plume stability.***

- **Trichloroethylene (TCE)**

  - Total of 50 samples were collected. Of these, 13 samples showed detected concentrations.
  - Nine samples below had detected concentrations greater than the screening value of 5 ug/L.

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Sub-area	Sample ID	Concentration (ug/L)	
		November 2008	June 2003
2B	MW-5I	89,000	120,000
	MW-10S	21.9	<1
	MW-11S	294	<1
	TP-4	16.3	160
6A	MW1	54.5	<1
6B	MW3	13.8	7.3
	RC8D	11.3	13
8A	MW10S	57.4	<1
	MW10D	15	<1

- During the previous sampling event in June 2003, concentrations in four of the above wells exceeded the screening value. Concentrations in some wells were below the detection limit of 1 ug/L.
- Half the detection limits of all the not-detected samples were below the screening value.
- ***Based on these, TCE in Sub-areas 2B, 6A, 6B, and 8A will be further evaluated for plume stability.***

- **Vinyl chloride**

  - Total of 50 samples were collected. Of these, eight samples showed detected concentrations.
  - Seven samples below had detected concentrations greater than the screening value of 2 ug/L.

Sub-area	Sample ID	Concentration (ug/L)	
		November 2008	June 2003
2B	MW-5I	181	180
	TP-4	3.87	5.3
3A	B42N6	7.75	47*
6B	B27W3D	527	120
	B28MW4	19.1	45
	MW3	789	1,000
	RC15	198	<1.0*

*: Concentrations in April 2006

  - During the previous sampling events, concentrations in above wells exceeded the screening value, except in RC15 in April 2006.
  - Half the detection limits of all the not-detected samples were below the screening value. Therefore, the detection limits were appropriate.
  - ***Based on these, vinyl chloride in Sub-areas 2B, 3A, and 6B will be further evaluated for plume stability.***

- **TPHs**

  - Total of 53 samples were collected for each of three TPH groups (TPH-GRO, TPH-DRO, and TPH-ORO).

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- Of these, only one sample for each TPH group showed detected concentration greater than the screening values of 18,100 ug/L for TPH-GRO, 34,300 ug/L for TPH-DRO, and 31,800 ug/L for TPH-ORO as below:

TPH Group	Sub-area	Sample ID	Concentration (ug/L)
			November 2008
TPH-GRO	2B	MW-5I	93,600
TPH-DRO	2B	MW-9S	800,000
TPH-ORO	2B	MW-9S	60,000

- Half the detection limits of all the not-detected samples were below the screening value.
- ***Based on these, TPHs in Sub-area 2B will be further evaluated for plume stability.***

- **n-Butylbenzene, sec-Butylbenzene, tert-Butylbenzene, 2-chlorotoluene, 1,2,4-Trimethylbenzene, MTBE, tert-Butyl alchol, and Tetrahydrofuran**

  - Total of 50 samples were collected for each of these chemicals.
  - All the chemicals had few detected concentrations; but none of detected concentrations exceeded screening values.
  - Only one of not-detected samples (MW-5I in Sub-area 2B) had half the detection limits greater than the screening levels for most of the chemicals.
  - During the previous sampling event in June 2003, all the chemicals except for 1,1-dichloroethylene and 1,2,4-trimethylbenzene were not-detected at detection limits below the screening values.
  - During the previous sampling event in June 2003, 1,2,4-Trimethylbenzene in MW-5I was detected at 21 ug/L which is slightly greater than the screening value of 15 ug/L.
  - Based on these, all the chemicals are not of concern.

- **Methylene Chloride**

  - Total of 50 samples were collected. Only one sample had detected concentration below the screening value of 4.8 ug/L.
  - Only two of not-detected samples (MW-5I in Sub-area 2B and RC15 in Sub-area 6B) had half the detection limits of 50 ug/L in MW-5I and 5 ug/L in RC15 greater than the screening value.
  - During the previous sampling event in June 2003, MW-5I had half the detection limit of 2.5 ug/L. During the previous sampling event in April 2006, RC15 had half the detection limit of 2.5 ug/L.
  - Methylene chloride is known as a common laboratory contaminant.
  - Based on these, methylene chloride is not of concern.

Based on above, the following are the conclusions:

- The following 14 chemicals exceeded the screening values and may be site

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related:

COCs	Sub-areas							
	2B	3A	3D	3H	6A	6B	6C	8A
Chromium (hexavalent)							X	
Manganese			X	X		X		X
1,1,2-Trichloroethane	X							
1,1-Dichloroethane						X		
1,1-Dichloroethylene	X					X		
Benzene						X		
cis-1,2-Dichloroethylene	X					X		
PCE	X					X	X	X
trans-1,2-Dichloroethylene	X					X		
TCE	X				X	X		X
Vinyl chloride	X	X				X		
TPH-GRO	X							
TPH-DRO	X							
TPH-ORO	X							

X: Chemicals exceeding screening values

- Groundwater monitoring plan will be developed for the above chemicals as part of Corrective Measures Study.

- Plume stability focusing on localized source areas, not based on the entire site may have to be evaluated.

If you have any questions, please call us.

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Table 1
Comparison of Groundwater Data Collected in 2008 with Screening Values (ug/L)
Beoing Tract 1, St. Louis, Missouri

COCs in Groundwater	MCLs	Regional Screening Levels	MRBCA DTLs	Screening Values	MW-A15	MW-A22	MW-A23	MW-A25	MW-A26	MW-A27	MW-A29	MW-A1	MW-A3	MW-A8	MW-A6	B48N1	MW-5I
					S. Bldg 45	S. Bldg 45	S. Bldg 45	S. Bldg 45	S. Bldg 45	S. Bldg 45	S. Bldg 45	Hush House	Hush House	2A	2A	2B	2B
Metals																	
Arsenic	10	0.045	10	**10**	na	na	na	na	na	na	na	**89**	**23**	**28.7**	**41.6**	**<25**	**37**
Barium	2,000	7,300	2,000	**2,000**	na	na	na	na	na	na	na	na	na	na	na	na	na
Cadmium	5	18	5	**5**	na	na	na	na	na	na	na	na	na	<2	<2	<2	<2
Chromium	100	-	100	**100**	na	na	na	na	na	na	na	na	na	na	na	na	na
Chromium (Hexavalent)	-	0.043	0.00337	**0.043**	na	na	na	na	na	na	na	na	na	na	na	na	na
Copper	1,300	1,500	624	**1,300**	na	na	na	na	na	na	na	na	na	na	na	na	na
Manganese	-	880	2,190	**880**	na	na	na	na	na	na	na	na	na	na	na	na	na
Mercury	2	0.57	50.7	**2**	na	na	na	na	na	na	na	na	na	na	na	na	na
SVOCs																	
Bis(2-ethylhexyl)phthalate	-	4.8	6	**4.8**	na	na	na	na	na	na	na	na	na	na	na	na	na
VOCs																	
1,1,2-Trichloro-1,2,2-trifluroethane	-	59,000	-	**59,000**	<20	<20	<20	<20	<20	<20	<20	<20	<20	na	na	<20	<1000
1,1,2-Trichloroethane	5	0.24	5	**5**	<5	<5	<5	<5	**1**	<5	<5	<5	<5	na	na	<5	**140**
1,1-Dichloroethane	-	2.4	24.9	**2.4**	**<5**	**<5**	**<5**	**<5**	**<5**	**<5**	**<5**	**<5**	**<5**	na	na	**<5**	**<250**
1,1-Dichloroethylene	7	340	7	7	<5	<5	<5	<5	<5	<5	<5	<5	<5	na	na	<5	**<250**
1,2,3-Trimethylbenzene	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	**6.42**	<5	na	na	<5	<250
1,2,4-Trimethylbenzene	-	15	7.06	**15**	<5	<5	<5	<5	<5	<5	<5	<5	<5	na	na	<5	**<250**
1,2-Dichloroethene, Total	-	-	-	-	<5	<5	<5	<5	**1.4**	<5	<5	<5	<5	na	na	**28.2**	**4430**
1-Chlorobutane	-	1500	-	**1,500**	<5	<5	**49**	<5	**1.8**	<5	<5	<5	<5	na	na	<5	<250
2-Chlorotoluene	-	730	61.9	**730**	<5	<5	<5	<5	<5	<5	<5	<5	<5	na	na	<5	<250
Acetone	-	22,000	2,970	**22,000**	<25	<25	**9.9**	<25	<25	<25	<25	**104**	**16**	na	na	<25	<1250
Benzene	5	0.41	5	**5**	**1.1**	<2	<2	<2	**1.4**	<2	<2	<2	<2	na	na	<2	**<100**
Carbon disulfide	-	1000	527	**1,000**	<5	<5	<5	<5	<5	<5	<5	**2**	<5	na	na	<5	<250
cis-1,2-Dichloroethylene	70	370	70	**70**	<5	<5	<5	<5	<5	<5	<5	<5	<5	na	na	**28.2**	**4,430**
Ehtylbenzene	700	1.5	700	**700**	<5	<5	<5	<5	<5	<5	<5	<5	<5	na	na	<5	<250
Isopropylbenzene	-	680	330	**680**	**1.9**	<5	**9.83**	<5	<5	<5	<5	**4.5**	**3.3**	na	na	<5	<250
m,p-Xylenes	-	1,200	-	**1,200**	**1.3**	<5	<5	<5	<5	<5	<5	<5	<5	na	na	<5	<250
Methyl tert-butyl ether	-	12	128	**12**	<2	<2	<2	<2	<2	<2	<2	<2	<2	na	na	<2	**<100**
Methylene chloride	-	4.8	5	**4.8**	<5	<5	<5	<5	<5	<5	<5	<5	<5	na	na	<5	**<100**
Naphthalene	-	0.14	1.09	**0.14**	**<10**	**<10**	**<10**	**<10**	**<10**	**<10**	**<10**	**<10**	**<10**	na	na	**<10**	**<500**
n-Butylbenzene	-	-	98.9	**98.9**	<5	<5	**3.7**	<5	<5	<5	<5	**3**	**1.2**	na	na	<5	**<250**
n-Propylbenzene	-	1,300	115	**1,300**	<5	<5	**7.11**	<5	<5	<5	<5	**4.9**	**3.7**	na	na	<5	<250
o-Xylene	-	1,200	-	**1,200**	<5	<5	<5	<5	<5	<5	<5	<5	<5	na	na	<5	<250
sec-Butylbenzene	-	-	106	**106**	<5	<5	**2.8**	<5	<5	<5	<5	**4.1**	**2.1**	na	na	<5	**<250**
tert-Butyl alcohol	-	-	286	**286**	<25	<25	<25	<25	<25	<25	<25	<25	<25	na	na	<25	**<1250**
tert-Butylbenzene	-	-	103	**103**	<5	<5	**1.2**	<5	<5	<5	<5	**1**	**1**	na	na	<5	**<250**
Tetrachloroethylene	5	2	5	**5**	<5	<5	<5	<5	<5	<5	<5	<5	<5	na	na	**4.1**	**<250**
Tetrahydrofuran	-	-	20.3	**20.3**	<20	<20	<20	<20	<20	<20	<20	<20	<20	na	na	<20	**<1000**
Toluene	1,000	2,300	1,000	**1,000**	<5	<5	<5	<5	<5	<5	<5	<5	<5	na	na	<5	<250
trans-1,2-Dichloroethylene	100	110	100	**100**	<5	<5	<5	<5	**1.4**	<5	<5	<5	<5	na	na	<5	**<250**
Trichloroethylene	5	2	5	**5**	<5	<5	<5	<5	<5	<5	<5	<5	<5	na	na	<5	**89,000**
Vinyl chloride	2	0.016	2	**2**	<2	<2	<2	<2	<2	<2	<2	<2	<2	na	na	<2	**181**
Xylenes	10,000	200	10,000	**10,000**	**1.3**	<5	<5	<5	<5	<5	<5	<5	<5	na	na	<5	<250
TPH																	
TPH-GRO	-	-	18,100	**18,100**	<500	<500	**2,550**	<500	<500	<500	<500	**230**	<500	**798**	<500	**180**	**93,600**
TPH-DRO	-	-	34,300	**34,300**	**403**	**230**	**1,040**	**220**	**684**	**220**	**210**	**2,780**	**2,790**	**200**	**230**	**230**	**230**
TPH-ORO	-	-	31,800	**31,800**	<300	<300	**290**	<300	**270**	<300	<300	**556**	**493**	<300	<300	<300	<300

Notes:
All concentrations in ug/L
DTL: Default target level
MCL: Maximum contaminant level
MRBCA: Missouri risk-based corrective action
na: Not analyzed
Highlighted and bold: Detected concentration exceeds screening value.
Highlighted: Half the detection limit exceeds screening value.

Table 1
Comparison of Groundwater Data Collected in 2008 with Screening Values (ug/L)
Beoing Tract 1, St. Louis, Missouri

COCs in Groundwater	MCLs	Regional Screening Levels	MRBCA DTLs	Screening Values	MW-6S	MW-8S	MW-8I	MW-9S	MW-10S	MW-11S	MW-11I	MW-11D	SWMU17-0B-1	TP-3	TP-4	TP-6	MW-A12
					2B	2B	2B	2B	2B	2B	2B	2B	2B	2B	2B	2B	2C
Metals																	
Arsenic	10	0.045	10	**10**	**39.6**	<25	**52.1**	**49**	**26.8**	**29.4**	<25	<25	**15**	**66.5**	**25**	**18**	na
Barium	2,000	7,300	2,000	**2,000**	na	na	na	na	na	na	na	na	na	na	na	na	na
Cadmium	5	18	5	**5**	**0.3**	**0.3**	**0.5**	**0.3**	<2	**4.2**	<2	**0.7**	<2	<2	<2	<2	na
Chromium	100	-	100	**100**	na	na	na	na	na	na	na	na	na	na	na	na	na
Chromium (Hexavalent)	-	0.043	0.00337	**0.043**	na	na	na	na	na	na	na	na	na	na	na	na	na
Copper	1,300	1,500	624	**1,300**	na	na	na	na	na	na	na	na	na	na	na	na	na
Manganese	-	880	2,190	**880**	na	na	na	na	na	na	na	na	na	na	na	na	na
Mercury	2	0.57	50.7	**2**	na	na	na	na	na	na	na	na	na	na	na	na	na
SVOCs																	
Bis(2-ethylhexyl)phthalate	-	4.8	6	**4.8**	na	na	na	na	na	na	na	na	na	na	na	na	na
VOCs																	
1,1,2-Trichloro-1,2,2-trifluroethane	-	59,000	-	**59,000**	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
1,1,2-Trichloroethane	5	0.24	5	**5**	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloroethane	-	2.4	24.9	**2.4**	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloroethylene	7	340	7	**7**	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2,3-Trimethylbenzene	-	-	-	**-**	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2,4-Trimethylbenzene	-	15	7.06	**15**	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2-Dichloroethene, Total	-	-	-	**-**	**3.8**	<5	<5	<5	<5	**7.58**	<5	<5	**2.3**	<5	**77.5**	<5	<5
1-Chlorobutane	-	1500	-	**1,500**	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
2-Chlorotoluene	-	730	61.9	**730**	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Acetone	-	22,000	2,970	**22,000**	<25	<25	<25	**308**	**73.4**	<25	<25	**5.6**	<25	**6**	**144**	**9.8**	<25
Benzene	5	0.41	5	**5**	<2	<2	<2	**1.9**	<2	<2	<2	<2	<2	<2	<2	<2	<2
Carbon disulfide	-	1000	527	**1,000**	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
cis-1,2-Dichloroethylene	70	370	70	**70**	**3.8**	<5	<5	<5	<5	<5	**11.58**	<5	<5	<5	**77.5**	<5	<5
Ehtylbenzene	700	1.5	700	**700**	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Isopropylbenzene	-	680	330	**680**	<5	<5	<5	<5	<5	<5	<5	<5	<5	**4.6**	<5	<5	<5
m,p-Xylenes	-	1,200	-	**1,200**	<5	<5	<5	<5	<5	<5	<5	<5	**1.4**	<5	<5	<5	<5
Methyl tert-butyl ether	-	12	128	**12**	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	**1**	<2	<2
Methylene chloride	-	4.8	5	**4.8**	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Naphthalene	-	0.14	1.09	**0.14**	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	**2.4**	<10	<10
n-Butylbenzene	-	-	98.9	**98.9**	<5	<5	<5	<5	<5	<5	<5	<5	<5	**7.63**	<5	<5	<5
n-Propylbenzene	-	1,300	115	**1,300**	<5	<5	<5	<5	<5	<5	<5	<5	<5	**3.3**	<5	<5	<5
o-Xylene	-	1,200	-	**1,200**	<5	<5	<5	**1.2**	<5	<5	<5	<5	<5	<5	<5	<5	<5
sec-Butylbenzene	-	-	106	**106**	<5	<5	<5	<5	<5	<5	<5	<5	<5	**4.9**	<5	<5	<5
tert-Butyl alcohol	-	-	286	**286**	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
tert-Butylbenzene	-	-	103	**103**	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Tetrachloroethylene	5	2	5	**5**	<5	**1.9**	<5	<5	<5	<5	<5	<5	<5	<5	**111**	<5	<5
Tetrahydrofuran	-	-	20.3	**20.3**	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Toluene	1,000	2,300	1,000	**1,000**	<5	<5	<5	<5	<5	<5	<5	**2.4**	**1.4**	<50	<50	<5	<5
trans-1,2-Dichloroethylene	100	110	100	**100**	<5	<5	<5	<5	<5	<5	<5	<5	**2.3**	<5	<5	<5	<5
Trichloroethylene	5	2	5	**5**	<5	<5	<5	<5	**21.9**	**294**	<5	<5	<5	<5	**16.3**	<5	<5
Vinyl chloride	2	0.016	2	**2**	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	**3.87**	<2	<2
Xylenes	10,000	200	10,000	**10,000**	<5	<5	<5	**1.2**	<5	<5	<5	<5	**1.4**	<5	<5	<5	<5
TPH																	
TPH-GRO	-	-	18,100	**18,100**	<500	<500	<500	<500	<500	**280**	<500	<500	<500	<500	**645**	<500	<500
TPH-DRO	-	-	34,300	**34,300**	**300**	<300	<300	**800,000**	**1,030**	**210**	**200**	**210**	**493**	**1,450**	**280**	**970**	**394**
TPH-ORO	-	-	31,800	**31,800**	**240**	<300	<300	**60,000**	**424**	<300	<300	<300	<300	**535**	**210**	**305**	**250**

Notes:
All concentrations in ug/L
DTL: Default target level
MCL: Maximum contaminant level
MRBCA: Missouri risk-based corrective action
na: Not analyzed
Highlighted and bold: Detected concentration exceeds screening value.
Highlighted: Half the detection limit exceeds screening value.

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Beoing Tract 1, St. Louis, Missouri

COCs in Groundwater	MCLs	Regional Screening Levels	MRBCA DTLs	Screening Values	MW-A13	B41MW-18	B42N6	MW-A4	B41MW-5	B41S5D	B2E3	B2E5	B4MW-9	B4MW-10	MW1	B27W3D	B28MW3
					2C	3A	3A	3C	3D	3D	3E	3E	3H	3H	6A	6BN	6BN
Metals																	
Arsenic	10	0.045	10	**10**	na	<25	na	na	<25	<25	na	na	<25	**15**	**12**	**26.8**	**35.3**
Barium	2,000	7,300	2,000	**2,000**	na	na	na	na	**403**	**382**	na	na	na	na	**184**	**145**	**1140**
Cadmium	5	18	5	**5**	na	na	na	na	<2	**2.1**	na	na	na	na	<2	**0.3**	<2
Chromium	100	-	100	**100**	na	na	na	na	na	na	na	na	na	na	<10	<10	<10
Chromium (Hexavalent)	-	0.043	0.00337	**0.043**	na	na	na	na	na	na	na	na	na	na	na	na	na
Copper	1,300	1,500	624	**1,300**	na	na	na	na	**6**	**128**	na	na	na	na	na	na	na
Manganese	-	880	2,190	**880**	na	na	na	na	**224**	**1,040**	na	na	**993**	**127**	na	**1,630**	**1,620**
Mercury	2	0.57	50.7	**2**	na	na	na	na	na	na	na	na	<0.2	<0.2	na	<0.2	<0.2
SVOCs																	
Bis(2-ethylhexyl)phthalate	-	4.8	6	**4.8**	na	na	na	na	na	na	na	na	na	na	na	<10	<10
VOCs																	
1,1,2-Trichloro-1,2,2-trifluroethane	-	59,000	-	**59,000**	<20	<20	<20	<20	<20	<20	<20	<20	na	na	<20	<20	<20
1,1,2-Trichloroethane	5	0.24	5	**5**	<5	<5	<5	<5	<5	<5	<5	<5	na	na	<5	<5	<5
1,1-Dichloroethane	-	2.4	24.9	**2.4**	<5	<5	<5	**1.4**	**13.8**	<5	<5	<5	na	na	<5	<5	**2**
1,1-Dichloroethylene	7	340	7	**7**	<5	<5	<5	<5	**1.1**	<5	<5	<5	na	na	<5	<5	<5
1,2,3-Trimethylbenzene	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	**5.91**	na	na	<5	<5	<5
1,2,4-Trimethylbenzene	-	15	7.06	**15**	<5	<5	<5	<5	<5	<5	<5	**9.38**	na	na	<5	<5	<5
1,2-Dichloroethene, Total	-	-	-	-	<5	<5	**16.8**	**1.2**	**2.6**	<5	<5	<5	na	na	<5	**584**	<5
1-Chlorobutane	-	1500	-	**1,500**	<5	<5	**4.6**	<5	<5	<5	**2.7**	<5	na	na	<5	<5	<5
2-Chlorotoluene	-	730	61.9	**730**	<5	<5	<5	<5	<5	<5	<5	<5	na	na	<5	<5	<5
Acetone	-	22,000	2,970	**22,000**	**81.4**	<25	<25	<25	<25	<25	<25	<25	na	na	<25	<25	<25
Benzene	5	0.41	5	**5**	<2	<2	**1.7**	<2	<2	<2	**1.5**	<2	na	na	<2	<2	<2
Carbon disulfide	-	1000	527	**1,000**	<5	<5	<5	<5	<5	<5	<5	<5	na	na	<5	<5	<5
cis-1,2-Dichloroethylene	70	370	70	**70**	<5	<5	**16.8**	**1.2**	**2.6**	<5	<5	<5	na	na	<5	**488**	<5
Ehtylbenzene	700	1.5	700	**700**	<5	<5	<5	<5	<5	<5	<5	**42.2**	na	na	<5	<5	<5
Isopropylbenzene	-	680	330	**680**	<5	<5	<5	<5	<5	<5	**2.6**	**8.65**	na	na	<5	<5	<5
m,p-Xylenes	-	1,200	-	**1,200**	<5	<5	<5	<5	<5	<5	<5	**3.4**	na	na	<5	<5	<5
Methyl tert-butyl ether	-	12	128	**12**	<2	<2	<2	<2	<2	<2	<2	<2	na	na	<2	<2	<2
Methylene chloride	-	4.8	5	**4.8**	<5	<5	<5	<5	<5	<5	<5	**2**	na	na	<5	<5	<5
Naphthalene	-	0.14	1.09	**0.14**	<10	<10	<10	<10	<10	<10	<10	<10	na	na	<10	<10	<10
n-Butylbenzene	-	-	98.9	**98.9**	<5	<5	<5	<5	<5	<5	**3**	**2.8**	na	na	<5	<5	<5
n-Propylbenzene	-	1,300	115	**1,300**	<5	<5	<5	<5	<5	<5	<5	**14.7**	na	na	<5	<5	<5
o-Xylene	-	1,200	-	**1,200**	<5	<5	<5	<5	<5	<5	<5	<5	na	na	<5	<5	<5
sec-Butylbenzene	-	-	106	**106**	<5	<5	<5	<5	<5	<5	<5	**1.2**	na	na	<5	<5	<5
tert-Butyl alcohol	-	-	286	**286**	<25	<25	<25	<25	<25	<25	<25	<25	na	na	<25	<25	<25
tert-Butylbenzene	-	-	103	**103**	<5	<5	<5	<5	<5	<5	<5	<5	na	na	<5	<5	<5
Tetrachloroethylene	5	2	5	**5**	<5	<5	<5	<5	**2.4**	<5	<5	<5	na	na	<5	<5	<5
Tetrahydrofuran	-	-	20.3	**20.3**	<20	<20	<20	<20	<20	<20	<20	<20	na	na	<20	<20	<20
Toluene	1,000	2,300	1,000	**1,000**	<5	<5	<5	<5	<5	<5	<5	<5	na	na	<5	**1.4**	<5
trans-1,2-Dichloroethylene	100	110	100	**100**	<5	<5	<5	<5	<5	<5	<5	<5	na	na	<5	**96.6**	<5
Trichloroethylene	5	2	5	**5**	<5	<5	<5	<5	<5	<5	<5	<5	na	na	**54.5**	<5	<5
Vinyl chloride	2	0.016	2	**2**	<2	<2	**7.75**	<2	<2	<2	<2	<2	na	na	<2	**527**	<2
Xylenes	10,000	200	10,000	**10,000**	<5	<5	<5	<5	<5	<5	<5	**3.4**	na	na	<5	<5	<5
TPH																	
TPH-GRO	-	-	18,100	**18,100**	<500	<500	**420**	<500	<500	<500	<500	**530**	<500	<500	<500	**623**	<500
TPH-DRO	-	-	34,300	**34,300**	**1,110**	<300	**467**	**250**	**312**	**290**	**403**	**506**	**220**	<300	<300	**460**	**260**
TPH-ORO	-	-	31,800	**31,800**	**460**	<300	**290**	**220**	**210**	**358**	**200**	<305	<300	<300	<300	<500	<300

Notes:
All concentrations in ug/L
DTL: Default target level
MCL: Maximum contaminant level
MRBCA: Missouri risk-based corrective action
na: Not analyzed
Highlighted and bold: Detected concentration exceeds screening value.
Highlighted: Half the detection limit exceeds screening value.

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COCs in Groundwater	MCLs	Regional Screening Levels	MRBCA DTLs	Screening Values	B28MW4	MW7	MW3	MW9S	RC8D	RC15	B25MW1	MW5CS	MW5DS	MW8AS	MW8AD	MW6	MW6D
					6BN	6BS	6BS	6BS	6BS	6BS	6C	6C	6C	6C	6C	6C	6C
Metals																	
Arsenic	10	0.045	10	**10**	**24**	<25	**22**	**26.8**	<25	**30.7**	<25	**18**	**16**	**24**	<25	<25	**18**
Barium	2,000	7,300	2,000	**2,000**	**431**	**163**	**714**	**1,070**	**541**	**613**	**333**	**624**	**334**	**393**	**257**	na	na
Cadmium	5	18	5	**5**	<2	**0.6**	**0.5**	**0.3**	**1.8**	**0.7**	**0.3**	**3.6**	**0.7**	**1**	**0.7**	na	na
Chromium	100	-	100	**100**	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	**4.6**	**55.1**
Chromium (Hexavalent)	-	0.043	0.00337	**0.043**	na	na	na	na	na	na	<5	**4**	**5**	**7**	<5	na	na
Copper	1,300	1,500	624	**1,300**	na	na	na	na	na	na	na	na	Na	na	na	na	na
Manganese	-	880	2,190	**880**	**662**	**275**	**2,390**	**3,140**	**4,600**	**7,290**	na	na	na	na	na	na	na
Mercury	2	0.57	50.7	**2**	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**0.27**	**0.22**	**0.08**	<0.2	na	na
SVOCs																	
Bis(2-ethylhexyl)phthalate	-	4.8	6	**4.8**	<6	<6	<6	<6	<6	**18**	na	na	na	na	na	na	na
VOCs																	
1,1,2-Trichloro-1,2,2-trifluroethane	-	59,000	-	**59,000**	**12,600**	<20	**21.6**	<20	<20	<40	<20	<20	<20	<20	<20	<20	<20
1,1,2-Trichloroethane	5	0.24	5	**5**	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloroethane	-	2.4	24.9	**2.4**	<5	<5	<5	<5	<5	**15.8**	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloroethylene	7	340	7	**7**	<5	<5	**25.1**	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5
1,2,3-Trimethylbenzene	-	-	-	**-**	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5
1,2,4-Trimethylbenzene	-	15	7.06	**15**	**3.6**	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5
1,2-Dichloroethene, Total	-	-	-	**-**	**239**	<5	**16,800**	<5	**30.8**	**214**	<5	<5	<5	<5	<5	na	na
1-Chlorobutane	-	1500	-	**1,500**	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5
2-Chlorotoluene	-	730	61.9	**730**	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5
Acetone	-	22,000	2,970	**22,000**	<25	<25	<25	<25	<25	**11**	<25	<25	**5.3**	<25	<25	<25	<25
Benzene	5	0.41	5	**5**	**109**	<2	<2	<2	<2	<4	<2	<2	<2	<2	<2	<2	<2
Carbon disulfide	-	1000	527	**1,000**	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5
cis-1,2-Dichloroethylene	70	370	70	**70**	**53.6**	<5	**16,600**	<5	**29.3**	**210**	<5	<5	<5	<5	<5	<5	<5
Ehtylbenzene	700	1.5	700	**700**	**6.44**	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5
Isopropylbenzene	-	680	330	**680**	**3.2**	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5
m,p-Xylenes	-	1,200	-	**1,200**	**10.9**	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5
Methyl tert-butyl ether	-	12	128	**12**	<2	<2	<2	<2	<2	<4	<2	<2	<2	<2	<2	<2	<2
Methylene chloride	-	4.8	5	**4.8**	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5
Naphthalene	-	0.14	1.09	**0.14**	<10	<10	<10	<10	<10	<20	<10	<10	<10	<10	<10	<10	<10
n-Butylbenzene	-	-	98.9	**98.9**	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5
n-Propylbenzene	-	1,300	115	**1,300**	**1.8**	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5
o-Xylene	-	1,200	-	**1,200**	**8.65**	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5
sec-Butylbenzene	-	-	106	**106**	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5
tert-Butyl alcohol	-	-	286	**286**	<25	<25	<25	<25	<25	**24**	<25	<25	<25	<25	<25	na	na
tert-Butylbenzene	-	-	103	**103**	<5	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5
Tetrachloroethylene	5	2	5	**5**	**7.41**	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	**6.2**	<5
Tetrahydrofuran	-	-	20.3	**20.3**	**6.3**	<20	<20	<20	<20	<40	<20	<20	<20	<20	<20	<20	<20
Toluene	1,000	2,300	1,000	**1,000**	**29.8**	<5	**1.1**	<5	<5	<10	<5	<5	<5	<5	<5	<5	<5
trans-1,2-Dichloroethylene	100	110	100	**100**	**186**	<5	**190**	<5	**1.6**	**3.9**	<5	<5	<5	<5	<5	<5	<5
Trichloroethylene	5	2	5	**5**	**1.5**	<5	**13.8**	<5	**11.3**	**3**	<5	<5	<5	**2**	<5	**2**	<5
Vinyl chloride	2	0.016	2	**2**	**19.1**	<2	**789**	<2	<2	**198**	<2	<2	<2	<2	<2	<2	<2
Xylenes	10,000	200	10,000	**10,000**	**19.5**	<5	<5	<5	<5	<10	<5	<5	<5	<5	<5	na	na
TPH																	
TPH-GRO	-	-	18,100	**18,100**	**519**	<500	**7,130**	<500	<500	<1000	<500	<500	<500	<500	<500	na	na
TPH-DRO	-	-	34,300	**34,300**	**304**	**200**	<300	<300	**220**	**11,200**	<300	**230**	**200**	**220**	<300	na	na
TPH-ORO	-	-	31,800	**31,800**	<300	<300	<300	<300	<300	**9,330**	<300	<300	<300	<300	<300	na	na

Notes:
All concentrations in ug/L
DTL: Default target level
MCL: Maximum contaminant level
MRBCA: Missouri risk-based corrective action
na: Not analyzed
Highlighted and bold: Detected concentration exceeds screening value.
Highlighted: Half the detection limit exceeds screening value.

Table 1
Comparison of Groundwater Data Collected in 2008 with Screening Values (ug/L)
Beoing Tract 1, St. Louis, Missouri

COCs in Groundwater	MCLs	Regional Screening Levels	MRBCA DTLs	Screening Values	MW10S	MW10D	B220N4	B220N6	MW4
					8A	8A	8B	8B	8B
Metals									
Arsenic	10	0.045	10	**10**	**11**	**17**	**14**	**15**	**16**
Barium	2,000	7,300	2,000	**2,000**	**257**	**398**	na	na	na
Cadmium	5	18	5	**5**	na	na	na	na	na
Chromium	100	-	100	**100**	<10	**13**	**4.2**	<10	<10
Chromium (Hexavalent)	-	0.043	0.00337	**0.043**	na	na	na	na	na
Copper	1,300	1,500	624	**1,300**	na	na	na	na	na
Manganese	-	880	2,190	**880**	**1,630**	**939**	na	na	na
Mercury	2	0.57	50.7	**2**	na	na	na	na	na
SVOCs									
Bis(2-ethylhexyl)phthalate	-	4.8	6	**4.8**	na	na	na	na	na
VOCs									
1,1,2-Trichloro-1,2,2-trifluroethane	-	59,000	-	**59,000**	<20	<20	na	na	na
1,1,2-Trichloroethane	5	0.24	5	**5**	<5	<5	na	na	na
1,1-Dichloroethane	-	2.4	24.9	**2.4**	**3.5**	<5	na	na	na
1,1-Dichloroethylene	7	340	7	**7**	<5	<5	na	na	na
1,2,3-Trimethylbenzene	-	-	-	-	<5	<5	na	na	na
1,2,4-Trimethylbenzene	-	15	7.06	**15**	<5	<5	na	na	na
1,2-Dichloroethene, Total	-	-	-	-	na	na	na	na	na
1-Chlorobutane	-	1500	-	**1,500**	<5	<5	na	na	na
2-Chlorotoluene	-	730	61.9	**730**	<5	<5	na	na	na
Acetone	-	22,000	2,970	**22,000**	<25	<25	na	na	na
Benzene	5	0.41	5	**5**	<2	<2	na	na	na
Carbon disulfide	-	1000	527	**1,000**	<5	<5	na	na	na
cis-1,2-Dichloroethylene	70	370	70	**70**	**1.3**	<5	na	na	na
Ehtylbenzene	700	1.5	700	**700**	<5	<5	na	na	na
Isopropylbenzene	-	680	330	**680**	<5	<5	na	na	na
m,p-Xylenes	-	1,200	-	**1,200**	<5	<5	na	na	na
Methyl tert-butyl ether	-	12	128	**12**	<2	<2	na	na	na
Methylene chloride	-	4.8	5	**4.8**	<5	<5	na	na	na
Naphthalene	-	0.14	1.09	**0.14**	<10	<10	na	na	na
n-Butylbenzene	-	-	98.9	**98.9**	<5	<5	na	na	na
n-Propylbenzene	-	1,300	115	**1,300**	<5	<5	na	na	na
o-Xylene	-	1,200	-	**1,200**	<5	<5	na	na	na
sec-Butylbenzene	-	-	106	**106**	<5	<5	na	na	na
tert-Butyl alcohol	-	-	286	**286**	na	na	na	na	na
tert-Butylbenzene	-	-	103	**103**	<5	<5	na	na	na
Tetrachloroethylene	5	2	5	**5**	<5	<5	na	na	na
Tetrahydrofuran	-	-	20.3	**20.3**	<20	<20	na	na	na
Toluene	1,000	2,300	1,000	**1,000**	<5	<5	na	na	na
trans-1,2-Dichloroethylene	100	110	100	**100**	<5	<5	na	na	na
Trichloroethylene	5	2	5	**5**	**57.4**	**15**	na	na	na
Vinyl chloride	2	0.016	2	**2**	**0.9**	<2	na	na	na
Xylenes	10,000	200	10,000	**10,000**	na	na	na	na	na
TPH									
TPH-GRO	-	-	18,100	**18,100**	na	na	<500	<500	<500
TPH-DRO	-	-	34,300	**34,300**	na	na	**220**	**400**	<300
TPH-ORO	-	-	31,800	**31,800**	na	na	<284	<600	<300

Notes:
All concentrations in ug/L
DTL: Default target level
MCL: Maximum contaminant level
MRBCA: Missouri risk-based corrective action
na: Not analyzed
Highlighted and bold: Detected concentration exceeds screening value.
Highlighted: Half the detection limit exceeds screening value.

Table 2(a)
Summary of Detected Chemicals in Groundwater Exceeding Screening Values
Boeing Tract 1, St. Louis, Missouri

Chemical	No. of Samples	No. of Detects	Detected Sample Exceedences												
			No. of Sample	Hush House	2A	2B	3A	3D	3H	6A	6BN	6BS	6C	8A	8B
Metals															
Arsenic	44	31	31	MW-A1 and MW-A3	MW-A8 and MW-A6	MW-5I, MW-6S, MW-8I, MW-9S, MW-10S, MW-11S, SWMU17-0B-1, TP-3, TP-4, and TP-6	--	--	B4MW-10	MW-1	B27W3D, B28MW3, and B28MW4	MW3, MW9S, and RC15	MW5CS, MW5DS, MW8AS, and MW6D	MW10S and MW10D	B220N4, B220N6, and MW4
Chromium (Hexavalent)	5	3	3	--	--	--	--	--	--	--	--	--	MW5CS, MW5DS, and MW8AS	--	--
Manganese	14	14	10	--	--	--	--	B41S5D	B4MW-9	--	B27W3D and B28MW3	MW3, MW9S, RC8D, and RC15	--	MW10S and MW10D	--
SVOCs															
Bis(2-ethylhexyl)phthalate	8	1	1	--	--	--	--	--	--	--	--	RC15	--	--	--
VOCs															
1,1,2-Trichloroethane	50	2	1	--	--	MW-5I	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	50	5	3	--	--	--	--	B41MW-5	--	--	--	RC15	--	MW10S	--
1,1-Dichloroethylene	50	2	1	--	--	--	--	--	--	--	MW3	--	--	--	--
Benzene	50	6	1	--	--	--	--	--	--	--	B28MW4	--	--	--	--
cis-1,2-Dichloroethylene	50	14	5	--	--	MW-5I and TP-4	--	--	--	--	B27W3D	MW3 and RC15	--	--	--
Naphthalene	50	1	1	--	--	TP-4	--	--	--	--	--	--	--	--	--
Tetrachloroethylene	50	6	3	--	--	TP-4	--	--	--	--	B28MW4	--	MW6	--	--
trans-1,2-Dichloroethylene	50	7	2	--	--	--	--	--	--	--	B28MW4	MW3	--	--	--
Trichloroethylene	50	13	9	--	--	MW-5I, MW-10S, MW-11S, and TP-4	--	--	--	MW1	--	MW3 and RC8D	--	MW10S and MW10D	--
Vinyl chloride	50	8	7	--	--	MW-5I and TP-4	B42N6	--	--	--	B27W3D and B28MW4	MW3 and RC15	--	--	--
TPHs															
TPH-GRO	53	12	1	--	--	MW-5I	--	--	--	--	--	--	--		--
TPH-DRO	53	43	1	--	--	MW-9S	--	--	--	--	--	--	--		--
TPH-ORO	53	18	1	--	--	MW-9S	--	--	--	--	--	--	--		--

Table 2(b)
Summary of Not Detected Chemicals in Groundwater Exceeding Screening Values
Boeing Tract 1, St. Louis, Missouri

Chemical	No. of Samples	No. of Detects	Half the Detection Limit Exceedences														
			No. of Sample	Hush House	S. Bldg 45	2B	2C	3A	3C	3D	3E	3H	6A	6BN	6BS	6C	8A
Metals																	
Arsenic	44	31	13	--	--	B48N1, MW-8S, MW-11I, and MW-11D	--	B41MW-18	--	B41MW-5 and B41S5D	--	B4MW-9	--	--	MW7 and RC8D	MW8AD, MW6, and B25MW1	--
Chromium (Hexavalent)	5	3	2	--	--	--	--	--	--	--	--	--	--	--	--	B25MW1 and MW8AD	--
SVOCs																	
Bis(2-ethylhexyl)phthalate	8	1	2	--	--	--	--	--	--	--	--	--	--	B27MW3D and B28MW3	--	--	--
VOCs																	
1,1-Dichloroethane	50	5	45	MW-A1 and MW-A3	MW-A15, MW-A22, MW-A23, MW-A25, MW-A26, MW-A27, and MW-A29	B48N1, MW-5I, MW-6S, MW-8S, MW-8I, MW-9S, MW-10S, MW-11S, MW-11I, MW-11D, SWMU17-0B-1, TP-3, TP-4, and TP-6	MW-A12 and MW-A13	B41MW-18 and B42N6	--	B41S5D	B2E3 and B2E5	--	MW1	B27MW3D and B28MW4	MW-3, MW-7, MW-9S, and RC8D	B25MW1, MW5CS, MW5DS, MW8AS, MW8AD, MW6 and MW6D	MW10D
1,1-Dichloroethylene	50	2	1	--	--	MW-5I	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	50	2	1	--	--	MW-5I	--	--	--	--	--	--	--	--	--	--	--
Benzene	50	6	1	--	--	MW-5I	--	--	--	--	--	--	--	--	--	--	--
Methyl tert-butyl ether	50	1	1	--	--	MW-5I	--	--	--	--	--	--	--	--	--	--	--
Methylene chloride	50	1	2	--	--	MW-5I	--	--	--	--	--	--	--	--	RC15	--	--
Naphthalene	50	1	49	MW-A1 and MW-A3	MW-A15, MW-A22, MW-A23, MW-A25, MW-A26, MW-A27, and MW-A29	B48N1, MW-5I, MW-6S, MW-8S, MW-8I, MW-9S, MW-10S, MW-11S, MW-11I, MW-11D, SWMU17-0B-1, TP-3, and TP-6	MW-A12 and MW-A13	B41MW-18 and B42N6	MW-A4	B41MW-5 and B41S5D	B2E3 and B2E5	--	MW1	B27MW3D, B28MW3, and B28MW4	MW-3, MW-7, MW-9S, RC8D, and RC15	B25MW1, MW5CS, MW5DS, MW8AS, MW8AD, MW6 and MW6D	MW10S and MW10D
n-Butylbenzene	50	6	1	--	--	MW-5I	--	--	--	--	--	--	--	--	--	--	--
sec-Butylbenzene	50	5	1	--	--	MW-5I	--	--	--	--	--	--	--	--	--	--	--
tert-Butyl alcohol	46	1	1	--	--	MW-5I	--	--	--	--	--	--	--	--	--	--	--
tert-Butylbenzene	50	3	1	--	--	MW-5I	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethylene	50	6	1	--	--	MW-5I	--	--	--	--	--	--	--	--	--	--	--
Tetrahydrofuran	50	1	1	--	--	MW-5I	--	--	--	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethylene	50	7	1	--	--	MW-5I	--	--	--	--	--	--	--	--	--	--	--

N

B220N5
B220N6
B220N4
MW4
MW10S
MW10D
MW2
JAMES S. MCDONNELL BOULEVARD
NORTH LINDBERGH BOULEVARD
RC15
RC13
MW9S
RC14
MW9D
MW3
MW3A
MW3B
RC8D
RC6D
MW8
MW8AD
MW8AS
MW5AS
MW5AD
MW5BS
MW5CS
B27W3D
B28MW3
B28MW1
B28MW4
B28MW2
B25MW2
B25MW1
B25MW4
MW5DS
MW1
MW7
MW6D
MW6
MW-5I
TP-6
MW-6S
TP-3
MW-11D
B41MW-18
BANSHEE ROAD
SWMU17-0B-1
MW-11S
TP-4
MW-10S
MW-11I
MW-8I
MW-9S
MW-8S
B48N1
B41MW-5
B41E2D
B41MW-7
B5MW-22
B4MW-9
B2E4
B4MW-10
B2E5
B2E3
MW-A6
MW-A16
MW-A8
MW-A7
MW-A19?
MW-A12
B42N7
B42N6
B41S5D
MW-A13
B42N8
MW-A24
MW-A26
MW-A29
MW-A25
MW-A28
MW-A5
MW-A15
MW-A27
MW-A14
MW-A22
MW-A23
B45CMW-3B
MW-A3
B45CMW-3A
MW-A1
MW-A17
MW-A18
MW-A4

LEGEND

Groundwater Monitoring Well

Railroad

Roadway

Building Outline

0 400

APPROX. SCALE (FEET)

RAM Group of Gannett Fleming, Inc.
5433 Westheimer, Suite 725, Houston, TX

Figure 2-1
Location of Monitoring Wells
(Shallow, Intermediate, and Deep Zones)
Boeing Tract 1
St. Louis, Missouri

November 2010/BR | RAM Group (049992)

APPENDIX F
CALCULATION OF GROUNDWATER TARGET CONCENTRATIONS

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APPENDIX F
CALCULATION OF GROUNDWATER TARGET CONCENTRATIONS

F.1 INTRODUCTIONS

This appendix presents the calculation of the groundwater target concentration for COCs with risk exceedances due to dermal contact with groundwater by a construction worker.

Per Table 2-1, the risks exceeded due to dermal contact with groundwater for the following sub-areas and COCs:

Sub-area	COCs	Exceedances	Risk Assessment
2B	PCE	Cumulative IELCR and Cumulative HI	RAM
6B	Benzo(a)anthracene	Total IELCR	RAM
	TCE	Cumulative HI	Tetra Tech
	Aroclor 1254	Cumulative IELCR	Tetra Tech

IELCR: Individual excess lifetime cancer risk
HI: Hazard index

The target concentration is a concentration of a COC in a specific media of concern at or below which the cumulative risk and/or total risk would not exceed the target risk (TR) levels. The following equation can be used to estimate the target concentration:

$$TC = \frac{RC \text{ or } EPC}{RRF} \quad \text{(F-1)}$$

$$RRF = \frac{CR}{TR} \quad \text{(F-2)}$$

where,

TC	=	Target concentration [µg/L]
RC or EPC	=	Representative concentration or exposure point concentration [µg/L]
CR	=	Calculated risk [-]
TR	=	Target risk level [-]
RRF	=	Risk reduction factor [-]

The term representative concentration (RC) was used by the RAM risk assessment. The term exposure point concentration (EPC) was used by the Tetra Tech risk assessment.

Each of the above input parameters is discussed below.

F.2 TARGET RISK LEVEL

To calculate the target concentrations, the following TR levels were used:

For carcinogenic health effects,

- Total IELCR for each chemical (sum of risk for all exposure pathways) of 1×10^{-5}, and
- Cumulative IELCR for each receptor (sum of risk for all chemicals and all exposure pathways) of 1×10^{-4}.

For non-carcinogenic health effects,

- Cumulative HI for each receptor (sum of HQ for all chemicals and all exposure pathways) of 1.0.

F.3 CALCULATED RISK

The following are the calculated risks for construction worker that exceeded the TR levels.

RAM Risk Assessment

Sub-area	COC	Total IELCR	Cumulative IELCR	Cumulative HI	Source
2B	PCE	N/A	3.35×10^{-4}	4.57	Table 3B-12(b) in Appendix C
6B	Benzo(a)anthracene	4.95×10^{-5}	N/A	N/A	Table 7B-10(b) in Appendix C

N/A: Not applicable since the risk did not exceeded the TR levels.

Tetra Tech Risk Assessment

Sub-area	COC	Cumulative IELCR	Cumulative HI	Source
6B	TCE	N/A	112*	Table 7 in Tetra Tech, 2008 and RAM Group, 2010j
	Aroclor 1254	9×10^{-4}	N/A	Table 7 in Tetra Tech, 2008

N/A: Not applicable since the risk did not exceeded the TR levels.
*: Sum of updated HI of 33 for TPHs (RAM Group, 2010j) and HI of 79 for risk driver chemicals (1,2-dichloroethene (total), benzene, trichloroethene, vinyl chloride, and mercury) (Tetra Tech, 2008)

F.4 RISK REDUCTION FACTOR

The RRFs were calculated for carcinogenic and non-carcinogenic effects using Equation (F-2), TR levels in Section F.2, and RC/EPC in Section F.3. For PCE in Sub-area 2B whose risk exceeded by both carcinogenic and non-carcinogenic TR levels, conservatively the higher value of two RRFs was used in the calculation. Therefore, the smaller target concentration value was

calculated.

The following are the calculated RRFs.

Sub-area	COC	Carcinogenic			Non-carcinogenic			RRF
		CR	TR	RRF	CR	TR	RRF	
2B	PCE	3.35×10^{-4}	1×10^{-4}	3.35	4.57	1	4.57	4.57
6B	Benzo(a)anthracene	4.95×10^{-5}	1×10^{-5}	4.95	N/A	N/A	N/A	4.95
	TCE	N/A	N/A	N/A	112	1	112	112
	Aroclor 1254	9×10^{-4}	1×10^{-4}	9	N/A	N/A	N/A	9

N/A: Not applicable

F.5 REPRESENTATIVE CONCENTRATION OR EXPOSURE POINT CONCENTRATION

The following are the RC or EPC used for the risks shown in Section F.3:

Sub-area	COC	RC/EPC [µg/L]	Source
2B	**PCE**	19,115	Table 3B-12(b) in Appendix C
6B	**Benzo(a)anthracene**	126	Table 7B-10(b) in Appendix C
	TCE	1,400	Table 7 in Tetra Tech, 2008
	Aroclor 1254	580	Table 7 in Tetra Tech, 2008

Note: COCs in bold font by the RAM risk assessment and COCs in regular font by the Tetra Tech risk assessment

F.6 TARGET CONCENTRATION

Using Equation (F-1) and RRFs in Section F.5, target concentrations have been calculated as shown below:

Sub-area	COC	RC/EPC [µg/L]	RRF [--]	TC [µg/L]
2B	PCE	19,115	4.57	4,183
6B	Benzo(a)anthracene	126	4.95	26
	TCE	1,400	112	13
	Aroclor 1254	580	9	64

These target concentrations are also referred in Section 3.0.

APPENDIX G
BOEING PERMITTED FACILITY EXCAVATED SOIL MANAGEMENT PLAN

BOEING PERMITTED FACILITY
EXCAVATED SOIL MANAGEMENT PLAN

January 2011

Boeing Defense, Space & Security – St. Louis
Environment, Health and Safety

BOEING PERMITTED FACILITY
EXCAVATED SOIL MANAGEMENT PLAN

I. Purpose/Summary

The overall objective of the Soil Management Plan (the "Plan") is to assure the continued protection of human health and the environment during current and future operations at the Boeing Permitted Facility. This Plan outlines the process and responsibilities associated with any development related disturbance of contaminated soil located on property subject to the jurisdiction of the current Missouri Hazardous Waste Management Facility (MHWMF) Part I Permit issued to Boeing as both owner and operator. This includes portions of the Boeing Tract I South permitted property now owned by the City of St. Louis, the Tract I North property now owned by GKN Technologies, and the buildings in both of these Tracts where Boeing still remains the owner of the property. The responsibilities described in this Plan apply to all development related activities at the permitted properties, including such activities conducted or initiated by any tenants or lessees of the parties hereto. This Plan outlines the planning, management and disposal procedures for contaminated soil that may be encountered during construction and maintenance activities, conducted on portions of the permitted property.

Specific responsibilities associated with any disturbance of soil by the owners of the property subject to the current permit may vary. To address each of the situations, Boeing, GKN and the City of St. Louis will be addressed in a section specific to the respective property ownership. Nothing in this document shall alter the various agreements between and among Boeing, MDC, GKN and the City of St. Louis regarding the allocation of costs for implementation of this Plan.

Upon final approval of a site-wide Corrective Measures Study by the Missouri Department of Natural Resources, this Plan may be modified to conform to the corrective measures implemented for the property.

II. General Requirements – Boeing Property

1. McDonnell Douglas Corporation (MDC) – St. Louis, a wholly-owned subsidiary of The Boeing Company, is responsible for all soil management associated with soil disturbance activities on portions of the permitted property owned by Boeing (see Property Ownership Map. Appendix A). Soil management as discussed in this section may include pre-project investigation, evaluation and documentation, sample collection and analysis, associated labor and equipment for excavation, transportation and disposal of soil.

2. GKN will be responsible for all soil management associated with soil disturbance activities on portions of the permitted property owned by GKN.

3. The City of St. Louis, owner and operator of Lambert-St. Louis International Airport® (the "City") will be responsible for all soil management associated with development related soil disturbance activities on portions of the permitted property owned by the City.

4. Boeing Environment, Health and Safety (EHS) will provide environmental project oversight for all soil disturbance activities covered by this Plan conducted on that portion of the permitted property owned by Boeing.

5. Prior to beginning any soil disturbance activities on permitted property now owned by Boeing, EHS will obtain the following information:

   a) Description of construction or maintenance activities that are being planned;
   b) Date project is to begin;
   c) Specific location of soil disturbance or soil excavation;
   d) Anticipated volume of soil that will be disturbed/excavated;
   e) Requirements for backfill and final finishing of excavation;
   f) Identification of any environmental contractors that will be used to perform any work;
   g) Identification of any land disturbance or stormwater management permits that may be required;
   h) Identification of any issues associated with the location of utility lines.

6. After a review of all of the project information on permitted property now owned by Boeing, a determination will be made by EHS as to the potential impact of the project with respect to areas with documented subsurface contamination.

   a) If it is determined that the project is not expected to encounter subsurface contamination, the construction contractor or group performing the work will be provided instructions should contamination be discovered during the project.

   b) If it is determined that the project is expected to encounter subsurface contamination, the construction contractor or group performing the work will be provided with specific information related to the location, depth(s) and level of contaminants. Boeing EHS will review the construction plans to determine if there is any feasible way to relocate the construction work to an area that is free of documented contamination.

      (1) If construction relocation proves infeasible:

         (a) Boeing will meet with all involved to discuss specific details and plans related to construction in areas of known contamination, including the following:

            1) Detailed information about the contamination;

2) Personal protective equipment needs/use and personnel training requirements and/or HAZWOPER qualifications;
3) Equipment decontamination procedures;
4) Soil management procedures;
5) Groundwater management procedures;
6) Stormwater management procedures;
7) Excavation zone limits;
8) Potential creation of preferential groundwater flow pathways (granular backfill, trenches, etc.);
9) Any engineering controls;
10) Additional details as needed.

(b) Temporary containment areas may need to be constructed related to staging/loading of soil. These areas should be relatively close to the point of generation. Soil must be placed on an engineered surface (concrete or plastic liner). A berm, at least six inches in height, must surround the surface to contain any runoff. Any additional measures identified in the Land Disturbance Permit (if applicable) must be addressed.

(c) Backfilling of the excavation will be performed to ensure that contamination is not spread through the creation of preferential groundwater flow pathways (granular backfill, trenches, etc.).

(d) The type of loading and hauling equipment used for the project will be determined by Boeing. Operations to control Foreign Object Damage (FOD) and dust at the job site must be conducted at regular intervals.

(e) Disposal facility and waste permitting requirements must be addressed as early in the process as possible.

(f) Hazardous Waste Management Facility Permit Corrective Action Conditions II. A. and III. A. require Boeing to notify MDNR and EPA within 15 days of the discovery of new Solid Waste Management Units (SWMUs), Areas of Concern (AOC), or newly-identified releases from previously identified SWMUs/AOC. Any information related to the foregoing discoveries/situations must be immediately communicated to Boeing EHS. Notification of discovery of situations that may require stabilization action(s) are also required by the MHWMF Part I permit. Any information related to the foregoing discoveries/situations must be immediately communicated to Boeing EHS. Boeing will notify the Missouri Department of Natural Resources (MDNR) and EPA, as appropriate.

(g) Any pre- or post-excavation sampling should be proposed in a plan for MDNR approval prior to implementation, except in the case of

emergencies. Post-excavation sampling of the floor and/or walls of an excavation will only occur in circumstances where additional soil characterization is necessary, or where post-excavation removal verification for soils shipped off-site is necessary.

III. General Requirements – GKN Property

1. GKN is responsible for all soil management associated with soil disturbance activities on portions of the permitted property owned by GKN (see Property Ownership Map. Appendix A). Soil management as discussed in this section may include pre-project investigation, evaluation and documentation, sample collection and analysis, associated labor and equipment for excavation, transportation and disposal of soil.

2. Boeing will be responsible for all soil management associated with soil disturbance activities on portions of the permitted property owned by Boeing (See Appendix A)

3. The City will be responsible for all soil management associated with development related soil disturbance activities on portions of the permitted property owned by the City.

4. GKN Environmental Safety and Health (ESH) will provide environmental project oversight for all soil disturbance activities covered by this Plan conducted on that portion of the permitted property owned by GKN.

5. Prior to beginning any soil disturbance activities on permitted property now owned by GKN, GKN Safety will obtain the following information:

   a) Description of construction or maintenance activities that are being planned;
   b) Date project is to begin;
   c) Specific location of soil disturbance or soil excavation;
   d) Anticipated volume of soil that will be disturbed/excavated;
   e) Requirements for backfill and final finishing of excavation;
   f) Identification of any environmental contractors that will be used to perform any work;
   g) Identification of any land disturbance or stormwater management permits that may be required;
   h) Identification of any issues associated with the location of utility lines.

6. After a review of all of the project information, a determination will be made by GKN as to the potential impact of the project with respect to areas with documented subsurface contamination.

   a) If it is determined that the project is not expected to encounter subsurface contamination, the construction contractor or group performing the work will be provided instructions should contamination be discovered during the project.

b) If it is determined that the project is expected to encounter subsurface contamination, the construction contractor or group performing the work will be provided with specific information related to the location, depth(s) and level of contaminants. GKN will review the construction plans to determine if there is any feasible way to relocate the construction work to an area that is free of documented contamination.

(1) If construction relocation proves infeasible:

(a) Boeing will meet with all involved to discuss specific details and plans related to construction in areas of known contamination, including the following:

1) Detailed information about the contamination;
2) Personal protective equipment needs/use and personnel training requirements and/or HAZWOPER qualifications;
3) Equipment decontamination procedures;
4) Soil management procedures;
5) Groundwater management procedures;
6) Stormwater management procedures;
7) Excavation zone limits;
8) Potential creation of preferential groundwater flow pathways (granular backfill, trenches, etc.);
9) Any engineering controls;
10) Additional details as needed.

(b) Temporary containment areas may need to be constructed related to staging/loading of soil. These areas should be relatively close to the point of generation. GKN has a designated area that is used to stage stock-piled soil requiring additional analysis located on the east section of the GKN property.

(c) Backfilling of the excavation will be performed to ensure that contamination is not spread through the creation of preferential groundwater flow pathways (granular backfill, trenches, etc.).

(d) The type of loading and hauling equipment used for the project will be determined by GKN. Operations to control Foreign Object Damage (FOD) and dust at the job site must be conducted at regular intervals.

(e) Disposal facility and waste permitting requirements must be addressed as early in the process as possible.

(f) Hazardous Waste Management Facility Permit Corrective Action Conditions II. A. and III. A. require Boeing to notify MDNR and EPA

within 15 days of the discovery of new Solid Waste Management Units (SWMUs), Areas of Concern (AOC), or newly-identified releases from previously identified SWMUs/AOC. Any information related to the foregoing discoveries/situations must be immediately communicated to Boeing EHS. Notification of discovery of situations that may require stabilization action(s) are also required by the MHWMF Part I permit. Any information related to the foregoing discoveries/situations must be immediately communicated to Boeing EHS. Boeing will notify the Missouri Department of Natural Resources (MDNR) and EPA, as appropriate.

(g) Any pre- or post-excavation sampling should be proposed in a plan for MDNR approval prior to implementation, except in the case of emergencies. Post-excavation sampling of the floor and/or walls of an excavation will only occur in circumstances where additional soil characterization is necessary, or where post-excavation removal verification for soils shipped off-site is necessary.

IV. General Requirements – City Property

1. The City and MDC have signed a Site Management and Redevelopment Agreement dated August 15, 2006 associated with soil management activities on portions of the permitted property owned by the City (the "Redevelopment Agreement"). This Plan addresses pre-project investigation, evaluation and documentation, sample collection and analysis, associated labor and equipment for excavation, transportation and disposal of contaminated soil. For purposes of this Plan, "contaminated" soils are soils which exceed the MRBCA Default Target Levels. This Plan between the City and Boeing specifically addresses the responsibilities of both parties related to responsibilities for contaminated soil management. As among Boeing, MDC and the City, nothing in this Plan is intended to alter or conflict with the Redevelopment Agreement. To the extent that anything in this Plan is inconsistent with the Redevelopment Agreement, the Redevelopment Agreement shall prevail.

2. Boeing and GKN will be responsible for all soil management associated with soil disturbance activities on portions of the permitted property not owned by the City.

3. The City will provide environmental project planning and oversight for all redevelopment activities which result in soil disturbance covered by this Plan conducted on that portion of the permitted property now owned by the City.

4. Prior to redevelopment activities on permitted property now owned by the City, the Airport Environmental Manager must be contacted by any construction contractor or group performing work that will disturb soil.

5. The construction contractor or group performing the work that will disturb soil shall provide the information listed below to the Airport Environmental Manager. In the event of an emergency, this information must be provided in a reasonable amount of time with as much information as available.

   a) Description of construction or maintenance activities that are being planned;
   b) Date project is to begin;
   c) Specific location of soil disturbance or soil excavation;
   d) Anticipated volume of soil that will be disturbed/excavated;
   e) Requirements for backfill and final finishing of excavation;
   f) Identification of any environmental contractors that will be used to perform any work;
   g) Identification of any land disturbance or stormwater management permits that may be required;
   h) Identification of any issues associated with the location of utility lines.

6. The Airport Environmental Project Manager will review all of the information received from the construction contractor or group, comparing this information with existing site characterization information found in the documents listed in Appendix B, which will be periodically updated to reflect interim corrective measures and final corrective measures approved by MDNR.

7. After a review of all of the project information, a determination will be made by the Airport Environmental Manager as to the potential impact of the project with respect to areas that are documented to be contaminated.

   a) If it is determined that pre-job sampling will be performed by the City, the City will provide copies of the Pre-job Sampling Plan to Boeing. If Boeing has any comments on the plan, Boeing will provide comments to such plans for consideration within fifteen (15) calendar days.

   b) If it is determined that the project is not expected to encounter subsurface contamination, the construction contractor or group performing the work will be provided instructions to follow should contamination be discovered during the project.

   c) If it is determined that the project is expected to encounter subsurface contamination, the construction contractor or group performing the work will be provided with specific information related to the location, depth(s) and level of contaminants. Reasonable steps shall be taken to avoid and minimize disturbance of the subsurface contamination.

      (1) The Airport Environmental Manager and the construction contractor or group performing the work will meet to discuss specific details and plans

related to construction in areas of known contamination including the following:

a) Detailed information about the contamination;
b) Personal protective equipment needs/use and personnel training requirements and/or HAZWOPER qualifications;
c) Equipment decontamination procedures;
d) Soil management procedures;
e) Groundwater management procedures;
f) Stormwater management procedures;
g) Excavation zone limits;
h) Potential creation of preferential groundwater flow pathways (granular backfill, trenches, etc.);
i) Any engineering controls;
j) Additional details as needed.

8. During the preliminary activities and planning for the project, the City will determine if the potential exists for the excavated contaminated soil to be returned to the original excavation or used elsewhere on the permitted property. To minimize soil handling and disposal requirements, excavated contaminated soil should be reused onsite as fill or backfill whenever feasible, so long as that reuse is protective of human health and the environment.

   a) The management of any excavated soil shall be in accordance with Appendix C, Summary of Designated Categories of Fill Material and Constituent Criterion.

   b) If the Airport Environmental Manager determines that the contaminated soil is anticipated to be re-used on site, the following steps will be followed:

      (1) The Airport Environmental Manager will identify the location for temporary management and replacement of the excavated contaminated soil. In most cases, soil is expected to be returned to the location from which it was excavated.

      (2) If the contaminated soil is to be reused in a location other than the original excavation, the specific location must be identified by the Airport Environmental Manager. The following general criteria are applicable when contaminated soil will be placed in a location other than the original excavation:

         (a) Location must be on the permitted property and not accessible by the general public, and
         (b) The soil must contain no visible free liquids (e.g., groundwater) and must be sufficiently dry so as to not produce free liquids following placement, and

(c) The location of the soil placement must be documented with the Airport Environmental Management Office if on property owned by the City, and shall also be provided to MDNR for placement in facility file.

(d) The location of the soil placement must be consistent with any and all of the activity and use limitations placed on the permitted property.

(3) Analytical data is required to support any contaminated soil reuse onsite. This data may come from existing corrective action identified in Appendix B, and/or from any additional pre or post excavation soil sampling and analysis. The Pre-job Sampling Plan must be submitted to MDNR as provided in Article V of this Plan identifying specific constituents and specific analytical parameters, including information on the purpose and use of the data related to soil reuse.

(4) Reuse of contaminated soil onsite is allowed only with written approval of the Pre-job Sampling Plan by MDNR as provided in Article V of this Plan, indicating all regulatory requirements have been addressed. Unless otherwise approved by MDNR, contaminated soil reused onsite must be free of debris and piping, and the reused contaminated soil is placed at a minimum of one (1) foot below surface. Contaminated soil reused onsite must not be used as finishing grade. Adequate controls must be in place to ensure soil reuse does not create additional contamination issues at the proposed reuse location (as determined by the Airport Environmental Manager). In addition, significant amounts of groundwater must not be transferred into the reuse area. Soil meeting these criteria will be placed in specific location identified in the Pre-job Sampling Plan approved by the department as provided in Article V of this Plan.

(5) The Airport Environmental Manager will maintain information of all contaminated soil management activities on portions of the permitted property owned by the City. This information will contain locations of contaminated soil reused onsite, locations of soil removed for disposal, and analytical data collected during soil management activities.

c) If it is determined by the City during the preliminary activities and planning for the project that the contaminated soil will NOT be reused on site:

(1) Soil samples will be collected and analyzed for contaminated soil disposal. The location, quantity and type of soil sample to be collected must be determined. The Pre-job Sampling Plan for collection of soil samples for disposal must include the objective and or purpose of this sampling (i.e., determining excavation limits/requirement, personal protective equipment requirements, etc.).

(2) The following issues must be addressed by the Airport Environmental Manager in coordination with the construction contractor or the group performing the work.

(e) Groundwater must be managed to ensure any contamination is not spread to uncontaminated areas. This may involve collection, treatment and proper disposal of contaminated groundwater.

(f) Specific actions must be discussed should debris or piping be encountered during the soil disturbance or excavation.

(g) Should asbestos-containing piping be encountered in the excavation, work will be stopped and an asbestos abatement contractor called to complete the operation.

(h) The Airport Environmental Manager will be notified for specific direction if any debris is encountered in an excavation. Any liquid associated with piping debris must be specifically addressed.

(i) Temporary containment areas may need to be constructed related to staging/loading of contaminated soil. These areas should be relatively close to the point of generation. Contaminated soil must be placed on an engineered surface (concrete or plastic liner). A berm at least six inches in height must surround the surface to contain any runoff.

(j) Backfilling of the excavation will be performed ensuring that contamination is not spread through the creation of preferential groundwater flow pathways (granular backfill, trenches, etc.)

(k) The type of loading and hauling equipment used for the project will be determined by the Airport Environmental Manager. Operations to control Foreign Object Damage (FOD) and dust at the job site must be conducted at regular intervals.

(3) Disposal of non-hazardous special waste soil will be addressed by the City. This may include obtaining special waste disposal approval from MDNR and St. Louis County Health Department.

(4) Waste soil that is determined to be hazardous waste will be managed by the City, except that waste soil determined to originate from Boeing's historical operations will be shipped off-site for disposal at a Boeing approved waste disposal facility under the U.S. EPA and MDNR ID number assigned to Boeing for the site. Any off-site shipments utilizing the Boeing ID number will be reviewed by Boeing prior to shipment, with Boeing responsible for waste profiling, manifesting, and regulatory reporting associated with such shipments.

9. Hazardous Waste Management Facility Permit Corrective Action Conditions II.A. and III.A. require Boeing to notify MDNR and EPA within 15 days of the discovery of new Solid Waste Management Units (SWMUs), Areas of Concern, (AOC) or newly-identified releases from previously identified SWMUs/AOC. Notification of discovery of situations that may require stabilization action(s) are also required by the MHWMF Part I permit. The discovery of any new Solid Waste Management Units (SWMUs), Areas of Concern, (AOC) or newly-identified releases from previously identified SWMUs/AOC, or the discovery of situations that may require stabilization action(s) must be communicated by the City to Boeing as soon as practicable. Boeing will notify the department and EPA, as appropriate.

V. MDNR Review and Approval

1. MDNR generally expects to review and approve a pre-job plan before redevelopment soil disturbance activities for "planned" construction but not for "emergency" repairs that involve disturbing contaminated soils within the permitted property. In the case of emergencies, after the fact reporting would be expected.

2. If redevelopment construction occurs on the permitted property owned by the City, the Redevelopment Agreement between MDC and the City specifies who is responsible for reimbursement of the Department's oversight costs.

3. To facilitate site redevelopment and repair/maintenance of utilities on site that may be in a contaminated area of the permitted property, this Soil Management Plan must be followed.

4. A plan view map, which is legible and clear, showing the following shall be submitted to the Department before soil disturbance activities for planned construction activities which will disturb contaminated soils commence:

   a) Location(s) and depth(s) of the necessary repair,
   b) Location(s) and depth(s) of any pre-job samples, and
   c) The location(s) of any known hazardous waste site (regulated units) or Solid Waste Management Units (SWMU's) and/or releases from such units which could be impacted by the proposed excavation/construction activities, and
   d) Any information relevant to disturbance of areas with known contamination.

5. Pre-job soil sampling/analysis and subsequent excavation activities on the permitted property could lead to the discovery of additional SWMUs/ AOC's. Any SWMUs/AOCs and/or new releases from known SWMUs/AOCs discovered by Boeing, or reported to Boeing by GKN or City, must be reported to the Department and EPA by Boeing in accordance with Special Permit Conditions V

and VI as applicable. The Department acknowledges that Boeing's knowledge of additional SWMUs/AOC's and/or new releases from known SWMUs/AOCs located on permitted property owned or operated by GKN or City, and obligation to report such information to the Department and EPA, is limited to such information as is provided by GKN or City.

6. When contaminated soil is approved for backfill into the excavation, a clean layer of soil must be placed at grade on top of the soil that is backfilled. The clean soil layer shall be a minimum of one (1) foot thick and be free of contamination above MRBCA DTLs levels. Any contaminated soil which is not used as backfill must be managed and disposed of in accordance with all applicable local, state, and federal requirements.

7. The Soil Management Plan requests must be submitted (electronically when possible) to the MDNR at least 15 working days prior to performing the work. When possible, requests should be grouped together and consolidated. The Project Manager will confirm MDNR's receipt of the request. Within 10 working days, MDNR will notify requestor Project Manager by phone or e-mail if the request is approved or if MDNR has questions. If MDNR's approval is verbal, that approval will be confirmed by letter or e-mail within 5 working days. If approval is not received within 10 working days the project manager will contact MDNR to resolve any issues related to the request and obtain approval within the remaining 5 working days of the verbal approval.

8. Nothing contained herein shall be construed as preventing or otherwise limiting the Project Manager's ability to respond to an emergency situation or condition (e.g.: water, sewer or gas line break) that requires disturbance of contaminated soil. Following mitigation of an emergency, the Project Manager shall contact the Department as soon as practicable to advise that contaminated soil has been disturbed and to receive further instructions as to what additional action, if any and reporting will be required to address final disposition of the contaminated soil.

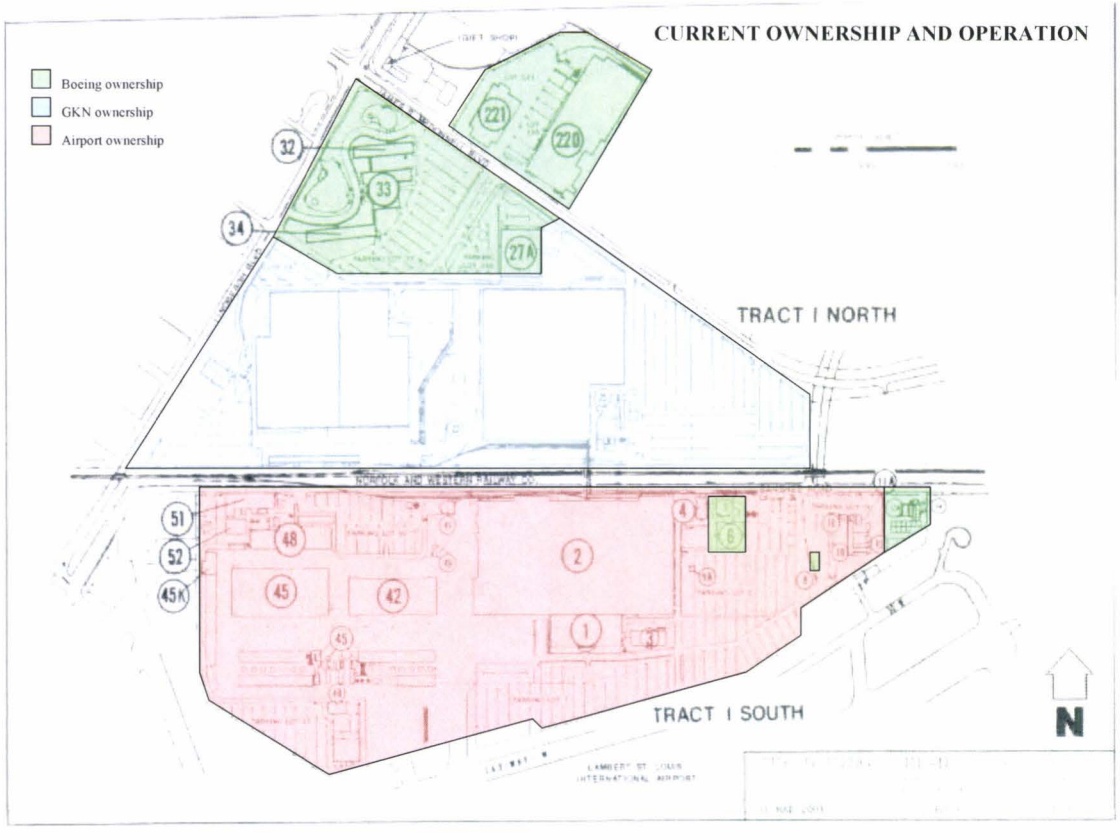
Signature Page

BOEING	
Signature	
Title	
Date	

CITY of ST. LOUIS	
Signature	
Title	
Date	

GKN	
Signature	
Title	
Date	

Appendix A
Property Ownership Map



Appendix B
Corrective Action Administrative Records

	Author	Title
5/29/1997	Environmental Science & Engineering, Inc., St. Louis, MO	RCRA Facility Investigation Workplan for McDonnell Douglas, Hazelwood, Missouri Facility, Volume I
12/18/1997	Heritage Environmental Services, Inc., Chicago, IL	Interim Measures Completion Report, McDonnell Douglas Aerospace, U.S. EPA ID No. MOD000818963, Tract I Facility, Hazelwood, Missouri
4/20/2001	Harding ESE, Inc., St. Louis, MO	RCRA Facility Investigation Workplan Addendum II for McDonnell Douglas, Hazelwood, Missouri
7/19/2001	Harding ESE, Inc., St. Louis, MO	RCRA Facility Investigation Workplan Addendum II for McDonnell Douglas, Hazelwood, Missouri
9/27/2002	Harding ESE, Inc., St. Louis, MO	Environmental Field Investigation Statement of Work for Boeing Tract I South Property, Hazelwood, Missouri
10/29/2002	Harding ESE, Inc., St. Louis, MO	Annual monitoring Report for Solid Waste management Unit 17, McDonnell Douglas, Hazelwood, Missouri
3/2003	Golder Associates, Inc., St. Charles, MO	Environmental Baseline Survey, Boeing Tract I South Facility, Hazelwood, MO
11/7/2003	MACTEC Engineering and Consulting, Inc., St. Louis, MO	Environmental Investigation Report for Boeing Tract I South Property
2/3/2004	MACTEC Engineering and Consulting, Inc., St. Louis, MO	Enhanced Bioremediation Pilot Test Report for Boeing Tract I, Hazelwood, Missouri
9/2004	Risk Assessment & Management Group, Inc., Houston, TX	Risk Based Corrective Action Report, Boeing Tract I, St. Louis, Missouri
12/2004	MACTEC Engineering and Consulting, Inc., St. Louis, MO	RCRA Facility Investigation Report for McDonnell Douglas, Hazelwood, Missouri
10/20/05	MACTEC Engineering and Consulting, Inc., St. Louis, MO	Interim Action Remedial Excavation Workplan, Solid Waste Management Unit 17, McDonnell Douglas, Hazelwood, Missouri
12/5/05	MACTEC Engineering and Consulting, Inc., St. Louis, MO	TPH Soil Vapor Sampling Workplan, Boeing Tract I, Hazelwood, Missouri

5/2006	MACTEC Engineering and Consulting, Inc., St. Louis, MO	Interim Action Remediation Excavation Completion Report, Boeing Tract I, McDonnell Douglas, Hazelwood, Missouri
6//2006	MACTEC Engineering and Consulting, Inc., St. Louis, MO	Interim Action Remedial Excavation Completion Report, Solid Waste Management Unit 17, McDonnell Douglas, Hazelwood, Missouri
3/2008	Tetra Tech EM, Inc., Lenexa, KS	Final Risk Assessment, Boeing Tract I Facility, St. Louis, Missouri
4/7/2010	RAM Group of Gannett Fleming, Inc., Houston, TX	Quality Assurance Plan, Boeing Tract 1, Hazelwood, Missouri
4/21/2010	RAM Group of Gannett Fleming, Inc., Houston, TX	Final Corrective measures Study Work Plan, The Boeing Company Tract 1, Hazelwood, Missouri
6/8/2010	RAM Group of Gannett Fleming, Inc., Houston, TX	Ground Water Gauging and Sampling-Spring 2010, Boeing Tract 1, Hazelwood, Missouri
12/2010	RAM Group of Gannett Fleming, Inc., Houston, TX	Ground Water Gauging and Sampling-Fall 2010, Boeing Tract 1, Hazelwood, Missouri

Appendix C
Summary of Designated Categories of Fill Materials and Constituent Criterion.

Category	Allowable Contaminant Limits	Allowable Uses/Requirements
Clean Fill*	Clean fill applies to soil, sand, gravel and rock where the concentration of all Constituents of Concern (COCs) are below their respective MRBCA Table B-1 DTLs or are below background levels.	Materials that qualify as "clean fill" do not require blanket beneficial use or site-specific approval and may be used without restriction in residential and non-residential applications. MDNR Water Protection Program approval may be required if placed in contact with surface water or groundwater. Subject to any applicable local approval requirements.
Blanket Beneficial Use Approval**	Blanket beneficial use applies to soil, sand, gravel and rock where the concentration of any COC is greater than its respective MRBCA Table B-1 DTL but all COCs are less than their respective MRBCA Table B-3 Risk-Based Target Levels for Residential Land Use Type 2 (Silty) Soil or below background. Materials containing any COC concentration greater than its respective MRBCA Table B-3 level are not approved for blanket beneficial use. Submission of a site-specific beneficial use request is required for materials with any COC concentration greater than its respective MRBCA Table B-3 level.	Materials that qualify for blanket beneficial use may be used, without additional site-specific approval, provided the material contains COC concentrations within allowable limits and the materials are placed on property subject to the jurisdiction of the Missouri Hazardous Waste Management Facility Permit. Transportation and placement of blanket beneficial use materials must be conducted in a manner that protects human health, worker safety and the environment

Site Specific Beneficial Use***	Site-specific beneficial use applies to soil, sand, gravel and rock where the concentration of <u>any</u> COC is greater than its respective MRBCA Table B-3 Risk-Based Target Level for Residential Land Use Type 2 (Silty) Soil but <u>all</u> COCs are less than their respective MRBCA Table B-6 Risk-Based Target Levels for Non-residential Land Use Type 2 (Silty) Soil Site-specific beneficial uses for the subject materials cannot be granted where <u>any</u> COC concentration is greater than its respective Table B-6 Risk-Based Target Level for Non-residential Land Use Type 2 (Silty Soil Type) or where these materials exhibit the characteristic of toxicity via Toxicity Characteristic Leaching Procedure (TCLP) testing.	Site-specific beneficial use of soil requires prior review and written approval by the department. The department shall be consulted as to applicable requirements for approval of site-specific beneficial use at the time any such use is proposed. Site-specific beneficial use will be limited to property subject to the jurisdiction of the Missouri Hazardous Waste Management Facility Permit and may require implementation of land use restrictions or other exposure controls in areas where site-specific beneficial use is approved.

* See MRBCA Table B-1 - Lowest Default Target Levels All Soil Types and Pathways. Guidance for determining background COC concentrations may be found in MRBCA Appendix M.

** See MRBCA Table B-3 – Tier 1 Risk Based Target Levels Residential Land Use Soil Type 2 (silty soil type).

*** See MRBCA Table B-6.

APPENDIX H
PROPOSED AUL LANGUAGE

ENVIRONMENTAL COVENANT

This Environmental Covenant is entered into by and between The City of St. Louis, a municipal corporation of the State of Missouri ("Owner"), and McDonnell Douglas Corporation, a wholly-owned subsidiary of The Boeing Company, and The Boeing Company ("Holders"), pursuant to the Missouri Environmental Covenants Act, Sections 260.1000 through 260.1039, RSMo.

RECITALS

WHEREAS, Owner, whose mailing address is _____, is the owner in fee simple of certain real property commonly known and numbered as _____, and legally described as: **[insert "legal description of the real property"]** the "Property;"

WHEREAS, Owner desires to grant to the Holders, whose mailing address is 100 North Riverside Plaza, Chicago, Illinois 60606-1596, this Environmental Covenant for the purpose of subjecting the Property to certain activity and use limitations as provided in the Missouri Environmental Covenants Act;

WHEREAS, the Property is the subject of RCRA Corrective Action pursuant to the requirements of Hazardous Waste Permit No. OSO 62284002, issued by the Missouri Department of Natural Resources (the "Permit"); and

WHEREAS, the Permit required environmental investigation of the Property, which investigation revealed the presence of groundwater and soil contamination at various portions of the Property; the results of which are documented in a Remedial Facility Investigation Report, dated _____; and

WHEREAS, the Permit required preparation of a Corrective Measures Study, which evaluated and proposed various remedial and other measures to remove, contain and otherwise address environmental contamination documented by the Remedial Facility Investigation Report; and

WHEREAS, in support of the Corrective Measures Study, a risk assessment was performed to determine the clean-up levels for the contamination identified in the Remedial Facility Investigation Report consistent with the Property's current and anticipated future use as an airport related maintenance and manufacturing facility; the results of which are documented in a Risk-Based Corrective Action Report, dated _____; and

WHEREAS, the Missouri Department of Natural Resources has reviewed and approved the Remedial Facility Investigation Report, the Corrective Measures Study, and the Risk-Based Corrective Action Report and has determined that this Environmental Covenant will support completion of the RCRA Corrective Action requirements of the

Permit by limiting future use of the property consistent with the assumptions underlying the Risk-Based Corrective Action Report and the Corrective Measures Study; and

WHEREAS, The term "Department" shall have the meaning given it in Section 260.1003(2) RSMo.

NOW THEREFORE, Owner, Holders, and the Department agree to the following:

1. Parties.
The Owner, the Holder and the Department are parties to this Environmental Covenant and may enforce it as provided for in Section 260.1030, RSMo.

2. Activity and Use Limitations.
As part of the implementation of institutional controls to support completion of the corrective actions required by the Permit, Owner hereby subjects the Property to, and agrees to comply with, the following activity and use limitations:

A. Restriction on Residential Use of the Property: The Property shall not be used, and the Owner shall not permit use of the Property, for single-family dwellings which individual residents may inhabit for 350 days or more per year for a cumulative period of 24 hours or more, or in the case of a child resident, for 350 days or more per year for a cumulative period of 6 years or more. If any Owner desires in the future to use the Property for a prohibited residential purpose, the Owner shall notify the Department 120 days in advance of such use and obtain Department approval for such use subject to conducting any further analyses and, as necessary, response action(s) as the Department may require as a condition of its approval. The Property may not be used in a manner that conflicts with this restriction.

B. Restriction on Use of Groundwater: The Owner of the Property shall not install or maintain, and shall not permit the installation and maintenance of, groundwater extraction wells on the Property for use as a drinking water supply or for other domestic purposes which may result in human ingestion of the groundwater or dermal exposure to the groundwater. This restriction shall not preclude installation and maintenance of groundwater wells on the Property for purposes of investigating, characterizing, or monitoring the groundwater. If any Owner desires in the future to use the groundwater for a prohibited purpose, the Owner shall notify the Department 120 days in advance of such use and obtain Department approval for such use subject to conducting any further analyses and, as necessary, response action(s) as the Department may require as a condition of its approval. The Property may not be used in a manner that conflicts with this restriction.

C. Restriction on Agricultural Use of the Property. The Property shall not be used, and the Owner shall not permit use of the Property, for agricultural or other uses which may result in routine dermal contact by individual non-residential

workers with surficial soils (defined as soils located zero to three feet below the ground surface) for 250 days or more for a cumulative period of 25 years or more. This restriction shall not preclude construction work on the Property notwithstanding that construction workers may have routine dermal contact with surficial soils, nor does this restriction preclude work involving grounds maintenance, installation and maintenance of landscaping and ornamental gardens, and/or installation and maintenance of irrigation systems associated with the foregoing. If any Owner desires in the future to use the Property for a prohibited agricultural purpose, the Owner shall notify the Department 120 days in advance of such use and obtain Department approval for such use subject to conducting any further analyses and, as necessary, response action(s) as the Department may require as a condition of its approval. The Property may not be used in a manner that conflicts with this restriction.

3. Running with the Land.
This Environmental Covenant shall be binding upon Owner and its successors, assigns, and Transferees in interest, and shall run with the land, as provided in Section 260.1012, RSMo, subject to amendment or termination as set forth herein. The term "Transferee," as used in this Environmental Covenant, shall mean any future owner of any interest in the Property or any portion thereof, including, but not limited to, owners of an interest in fee simple, mortgagees, easement holders, and/or lessees.

4. Location of Administrative Record for the Environmental Response Project.
The administrative record for the environmental response project for the Property is located at [TBD].

5. Enforcement.
Compliance with this Environmental Covenant may be enforced as provided in Section 260.1030, RSMo. Failure to timely enforce compliance with this Environmental Covenant or the activity and use limitations contained herein by any party shall not bar subsequent enforcement by such party and shall not be deemed a waiver of the party's right to take action to enforce any non-compliance. Nothing in this Environmental Covenant shall restrict any person from exercising any authority under any other applicable law.

6. Right of Access.
Owner hereby grants to each of the Holders, the Department and their respective agents, contractors, and employees, the right of access at all reasonable times to the Property for implementation, monitoring or enforcement of this Environmental Covenant. Nothing herein shall be deemed to limit or otherwise affect the Department's rights of access and entry under federal or state law.

~~**7. (May be optional depending on the Site.) Compliance Reporting.**~~
~~Owner/Transferee shall submit to the Holder and the Department, by no later than January 31st of each year, documentation verifying that the activity and use limitations imposed hereby were in place and complied with during the preceding calendar year.~~

~~Such reports shall be sent to the Holder and the Department at the address that appears in paragraph 18 (Notice) below. The Holder and the Department may change their/its mailing address by written notice to Owner/Transferee. The Compliance Report shall include the following statement, signed by Owner/Transferee: To the best of my knowledge, after thorough investigation, I certify that the information contained in or accompanying this submission is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.~~ [PROPOSE TO DELETE THIS REQUIREMENT AS UNECCESSARY GIVEN THE USE LIMITATIONS]

8. Additional Rights.
None.

9. Notice upon Conveyance.
Each instrument hereafter conveying any interest in the Property or any portion of the Property shall contain a notice of the activity and use limitations set forth in this Environmental Covenant, and provide the recording reference for this Environmental Covenant. The notice shall be substantially in the following form: THE INTEREST CONVEYED HEREBY IS SUBJECT TO AN ENVIRONMENTAL COVENANT, DATED _____,20__, RECORDED IN THE OFFICE OF THE RECORDER OF DEEDS OF _____ COUNTY, _____, ON _____, 20__, AS DOCUMENT ____, BOOK___, PAGE ____. Owner/Transferee shall notify the Holder and the Department within ten (10) days following each conveyance of an interest in any portion of the Property. The notice shall include the name, address, and telephone number of the Transferee, and a copy of the deed or other documentation evidencing the conveyance.

10. Notification Requirement.
Owner shall notify the Department following transfer of any interest in the Property or of any changes in use of the Property inconsistent with the Activity and Use Limitations specified in paragraph 2 above.

11. Representations and Warranties.
Owner hereby represents and warrants to the Holders and the Department that Owner has the power and authority to enter into this Environmental Covenant, to grant the rights and interests herein provided and to carry out all of Owner's obligations hereunder; that Owner is the sole owner of the Property and holds fee simple title, which is free, clear and unencumbered; to the extent that other interests in the Property exist, Owner has agreed to subordinate such interest to this Environmental Covenant, pursuant to Section 260.1006.4, RSMo, and the subordination agreement (attached hereto as Exhibit __ or recorded at _____); that Owner has identified all other parties who hold any interest (e.g., encumbrance) in the Property and notified such parties of Owner's intention to enter into this Environmental Covenant; and that this Environmental Covenant will not materially violate or contravene or constitute a material default under any other agreement, document or instrument to which Owner is a party or by which Owner may be bound or affected.

12. Amendment or Termination.
This Environmental Covenant may be amended or terminated by consent signed by the Department and the Holders. Signatories to this Environmental Covenant other than Department and the Holders hereby waive the right to consent to any amendment to, or termination of, this Environmental Covenant. Within thirty (30) days of signature by all requisite parties on any amendment or termination of this Environmental Covenant, Owner/Transferee shall file such instrument for recording with the office of the recorder of the county in which the Property is situated, and within thirty (30) days of the date of such recording, Owner/Transferee shall provide a file- and date-stamped copy of the recorded instrument to the Department and the Holder.

13. Severability.
If any provision of this Environmental Covenant is found to be unenforceable in any respect, the validity, legality, and enforceability of the remaining provisions shall not in any way be affected or impaired.

14. Governing Law.
This Environmental Covenant shall be governed by and interpreted in accordance with the laws of the State of Missouri.

15. Recordation.
Within thirty (30) days after the date of the final required signature upon this Environmental Covenant, Owner shall record this Environmental Covenant with the office of the recorder of the county in which the Property is situated.

16. Effective Date.
The effective date of this Environmental Covenant shall be the date upon which the fully executed Environmental Covenant has been recorded with the office of the recorder of the county in which the Property is situated.

17. Distribution of Environmental Covenant.
Within thirty (30) days following the recording of this Environmental Covenant, or any amendment or termination of this Environmental Covenant, Owner/Transferee shall, in accordance with Section 260.1018, RSMo, distribute a file- and date-stamped copy of the recorded Environmental Covenant to: (a) each signatory hereto; (b) each person holding a recorded interest in the Property; (c) each person in possession of the Property; (d) each municipality or other unit of local government in which the Property is located; and (e) any other person designated by the Department.

18. Notice.
Any document or other item required by this Environmental Covenant to be given to another party hereto shall be sent to:

If to Owner:
[name]
[address]

If to Holder:
[name]
[address]

If to Department:
[name]
[address]

The undersigned represent and certify that they are authorized to execute this Environmental Covenant.

IT IS SO AGREED:

FOR OWNER

By: _____ Date: _____
Name (print):
Title:
Address:
[Consult Section 442.210, RSMo for acknowledgement requirements.]
STATE OF _____)
)
COUNTY OF _____)
On this ___ day of _____, 20__, before me, a Notary Public in and for said state, personally appeared (Name), (Title) of _____(Corporate Name), known to me to be the person who executed the within Environmental Covenant on behalf of said corporation and acknowledged to me that he/she executed the same for the purposes therein stated.

_____
Notary Public

FOR HOLDERS
By: _____ Date: _____
Name (print):
Title:
Address:
STATE OF _____)
)
COUNTY OF _____)
On this ___ day of _____, 20__, before me, a Notary Public in and for said state, personally appeared (Name), (Title) of _____(Corporate Name),

known to me to be the person who executed the within Environmental Covenant in behalf of said corporation and acknowledged to me that he/she executed the same for the purposes therein stated.

_____
Notary Public

FOR DEPARTMENT
By: _____ Date: _____
Name (print):
Title:
Address:
STATE OF _____)
)
COUNTY OF _____)
On this ___ day of _____, 20__, before me, a Notary Public in and for said state, personally appeared (Name), (Title) of _____(Corporate Name), known to me to be the person who executed the within Environmental Covenant in behalf of said corporation and acknowledged to me that he/she executed the same for the purposes therein stated.

_____
Notary Public